

Baltimore, MD • June 7-12, 1998

http://estd-www.nrl.navy.mil/ims/1998ims.html



June 1998 IEEE MTT-S International Microwave Symposium Week

			SUN/7				MON/8				TUE/9				WED/10				THU/11				FRI/12			
Activity		Location	M	N	A	E	M	N	A	E	M	N	A	E	M	N	A	E	M	N	A	E	M	N	A	E
MTT	Workshops	BCC																								
	Plenary Session	BCC																								
	Symposium	BCC																								
	Panel Sessions	BCC																								
	Student Paper Contest	BCC																								
	Interactive Forum	BCC																								
Exhibits		BCC																								
	μAPS	BCC																								
RFIC	Workshops	BCC																								
	Symposium	BCC																								
	Panel Session	BCC																								
ARFTG	Conference	Hyatt Regency																								
	Exhibits	Hyatt Regency																								
Social	Workshop Bkfst, Lunch	BCC																								
	Speakers' Breakfast	BCC																								
	MTT Members' Bkfst	BCC																								
	RFIC Reception	Hyatt Regency																								
	MJ Reception	MD Science Center																								
	Crab Feast	Oriole Ballpark																								
	Industry Reception	Hyatt Regency																								
	Awards Banquet	Hyatt Regency																								
	ARFTG Breakfast	Hyatt Regency																								
ARFTG Awards Lunch	Hyatt Regency																									

1998 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM/MICROWAVE WEEK

		MORNING		LUNCHTIME		AFTERNOON		EVENING					
SESSION TIME		8:00–9:40 AM		10:10–11:50 AM		12:00–1:15 PM		1:20–3:00 PM		3:30–5:10 PM			
Sunday, June 7		Workshop Registration 7 to 9 AM		Workshop Lunch 12 to 1 PM		Registration 2 to 9 PM							
		WSA: Wireless Local Loop Systems: Technologies, Opportunities and Market									RFIC Reception 7 to 10 PM Hyatt		
		WSB: Low Cost Si-based Technology for Wireless Applications											
		WSC: Comparison of the Various MCM Technologies for Microwave Multichip Assemblies											
Monday, June 8		Registration 7 AM to 5 PM									Microwave Journal/ MTT-S Reception 6 to 10 PM Maryland Science Center		
		RFIC Symposium 8:30 AM to 5 PM											
		WMA: Computer-aided Design, Electromagnetic Modeling and Measurement for Electronics Packaging and Interconnects											
		WMB: Microwave/Lightwave Methods for Indoor and Outdoor Wireless and Mobile Communication											
		WMC: Low Cost Digital and Analog Optoelectronic Modules: Manufacturing and Systems Insertion											
		WMD: Advances in Amplifier Linearization											
		WME: Multilayer Microwave Circuits											
		WMF: Accurate Dielectric Characterization of PWB Substrates			PMON1: Levels of Integration for RFICs? The One-chip Radio: Realistic Goal or Utter Nonsense?			WMI: Analog-to-digital Converters for Digital Receiver Systems					
		WMG: Cryogenics: A New Beginning						WMJ: Technologies for Tunable Microwave Systems					
		WMH: Integration of Ferrite Devices into Future Radar, Wireless and Space Systems						WMK: IMT-2000: What is It and What is in It for the Microwave Community?					
Tuesday, June 9		Registration 7 AM to 5 PM									Maryland Crab Feast 6:30 to 9 PM Oriole Park at Camden Yard		
		IMS Exhibition 9 AM to 5 PM; μ APS 12 to 5 PM											
		Student Paper Competition – Camden Lobby 2 to 5 PM											
	Room 307/ 308/	TU1A–Ballroom Plenary Session: Progress Through Microwaves Keynote Speakers: Benjamin Pontano, COMSAT Laboratories Arye Rosen, Sarnoff Corp. Arnold Greenspon, Thomas Jefferson Medical College		TU2A: Modeling and Optimization for CAD		PTUE2: Key Policy Issues in Microwave Spectrum Management PTUE3: Future Research Directions in Microwave CAD		TU3A: Modeling and Characterization of FETs and HEMTs		TU4A: Nonlinear Simulation and Modeling			
	Room 309/ 310/			TU2B: Joint RFIC/IMS Session: mm-wave MMICs for Receiver Applications				TU3B: Joint RFIC/IMS Session: Wireless ICs and Circuits		TU4B: Joint RFIC/IMS Session: Multifunction MMW ICs			
	Room 314/ 317/			TU2C: Focused Session: RF and Microwave Implications of Digital TV Broadcasting				TU3C: Wireless Components and Systems		TU4C: Focused Session: Low Power RF/Microwave and mm-wave Wireless Technologies			
	Room 323/ 329/			TU2D: Joint RFIC/IMS Session: ISM/Cellular/PCS ICs				TU3D: Joint RFIC/IMS Session: mm-wave MMIC Technology		TU4D: Joint RFIC/IMS Session: Transceiver ICs			
	Room 329/ 330/			TU2E: Planar Components				TU3E: Waveguide Components		TU4E: Wireless and Satellite Applications of Superconductivity			
	Wednesday, June 10		Registration 7 AM to 5 PM									Industry-hosted Cocktail Reception 6 to 7:30 PM Hyatt Awards Banquet 7:30 to 10 PM Hyatt	
			IMS Exhibition & μ APS 9 AM to 5 PM										
		Student Paper Competition – Camden Lobby 8 to 10 AM											
Room 307/ 308/		WE1A: mm/Sub mm-wave Mixers and Multipliers		WE2A: mm-wave Technology and Applications		WEIF: Interactive Forum I, 2:30 to 5 PM – Camden Lobby							
Room 309/ 310/		WE1B: Focused Session: Historical Perspective on Microwave Systems in the Baltimore/Washington Area		WE2B: Focused Session: Microwave and Wireless Education in a Rapidly Changing Environment		WE3A: New Guided-wave Effects		WE4A: Properties of Substrates and Artificial Surfaces					
Room 314/ 317/		WE1C: Power Amplifier Technology for Wireless Applications		WE2C: Microwave Power Amplifiers		WE3B: Low Noise Techniques		WE4B: Packaging and Interconnects					
Room 323/ 329/		WE1D: Time Domain Methods I		WE2D: Nonlinear Device Modeling		WE3C: High Power, Low Distortion Amplifiers		WE4C: Focused Session: HF/VHF/UHF Power Amplifiers					
Room 329/ 330/		WE1E: SAW Systems and Sensors		WE2E: Ferrite Devices: UHF to W-band		WE3D: Spectral Regrowth and Distortion of Modulated Signals		WE4D: Nonlinear Modeling of Circuit Field Interactions					
						WE3E: Biological Effects and Medical Applications		WE4E: High Power Generation, Amplification and Control Components					
Thursday, June 11			Workshop Registration 7 to 5 PM										
		IMS Exhibition and μ APS 9 AM to 3 PM											
		THIF: Interactive Forum II, 2:30 to 5 PM – Camden Lobby											
	Room 307/ 308/	TH1A: Active and Planar Filters		TH2A: High Q Filters		TH3A: Quasi-optical Amplifier Arrays				TH4A: Active Antennas and Arrays			
	Room 309/ 310/	TH1B: Joint ARFTG/IMS Session: Commercial and Industrial Microwave Systems		TH2B: Microwave Measurements		TH3B: Network Measurements				TH4B: Joint ARFTG/IMS Session: Digital Interconnection Techniques and Characterization at GHz Freq.			
	Room 314/ 317/	TH1C: Devices for Microwave Photonic Systems		TH2C: Focused Session: Optical Beam Forming for Phased Arrays		TH3C: Photonics for Wireless and Radar Systems				TH4C: Microwave Systems and Applications			
	Room 323/ 329/	TH1D: Application Oriented Techniques in Field Theory		TH2D: Time Domain Methods II		TH3D: Frequency Domain Techniques							
	Room 329/ 330/	TH1E: Multilayer and 3D Hybrid Technology		TH2E: Frequency Conversion Technology		TH3E: Signal Generation and Control Devices							
	Friday, June 12		Workshop Registration 7 to 9 AM										
			ARFTG Conference & Exhibition 7:30 AM to 5 PM – Hyatt										
		WFA: Designing RF Receivers for Wireless Systems											
		WFB: High Frequency Silicon Micromachining and Multichip Integration											
		WFC: The Emergence of Millimeter-wave Video-on-demand Systems											
		WFD: Computer-aided Design for Manufacturability											
		WFE: Comparative Filter Technologies for Communications Systems											
		WFF: High Power MMIC Amplifiers											
		WFG: New Developments in Time Domain Methods for Nonlinear Design			Workshop Lunch 12 to 1 PM ARFTG Lunch 12 to 1 PM – Hyatt			WFI: Product Development through Foundries					
		WFH: Novel Approaches to Photonic-antenna Integration			WFJ: Antenna Technology for Wireless Applications								



1998 IEEE MTT-S International Microwave Symposium & Exhibition

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The Baltimore and Washington DC/Northern Virginia Chapters of the IEEE Microwave Theory and Techniques Society have joined forces to make the 1998 International Microwave Symposium (IMS) and Exhibition the most significant event of the year for microwave technologists. The Symposium has become a busy week for attendees. Technical activities include workshops on Sunday, Monday and Friday, and technical sessions and lunchtime panel sessions on Tuesday, Wednesday and Friday. The Radio Frequency Integrated Circuits (RFIC) Symposium runs Monday and Tuesday, sharing with IMS a special focus on "Wireless" on Tuesday. The Automatic Radio Frequency Techniques Group (ARFTG) concludes the week with its conference on Friday.



Steven Stitzer

The IMS '98 theme, "Progress through Microwaves," has several meanings. The application of microwave technology has benefitted mankind in many ways during the last two-thirds of this century. Wartime radar has evolved into the capability for everyone to see the weather over large areas virtually instantaneously. Medical applications of microwaves have been developing steadily. Worldwide communications over microwave links, both terrestrial and satellite based, are commonplace. Technologies that started out in expensive military and commercial systems have filtered down to affordable items for the individual consumer, from the microwave oven to the cellular telephone. And from the design engineer's side, our ability to model, design, build and test practical microwave hardware has advanced

dramatically, moving from hand-drawn Smith charts to the ubiquitous personal computer. We are also progressing outward in the frequency spectrum. We have always been pushing to make use of higher frequencies. Now we are also moving lower to meet the upward shift in the traditional RF world and the digital world as clock frequencies continue to increase. All of these aspects will be covered during IMS '98.

We are testing a few new ideas this year:

- Purchase of the printed digest will be optional. The CD ROM version will be issued as part of the basic registration fee, which has been lowered from last year. If you purchase the printed digest, your total cost will be the same as last year. Details are on page 7.
- Pre-registration will be available on line through the Internet as well as by traditional paper forms. On-site registration will be facilitated by self-operated terminals in the Convention Center lobby. Registration details can be found on page 11.
- The Plenary Session is first thing on Tuesday morning. We hope the opening ceremony will really wake you up, so plan to come early. See the full description on page 4.

All technical events of IMS '98 will take place in the newly expanded Baltimore Convention Center, which is located in downtown Baltimore next door to our world-famous Inner Harbor. This is a uniquely popular setting for the Symposium, with lots of things to see and do in your "spare time." On behalf of the Steering Committee and both local Chapters, welcome to Baltimore!

Steven Stitzer, Chairman, IMS '98 Steering Committee

A MESSAGE FROM THE TECHNICAL PROGRAM CHAIRMEN

Welcome to Baltimore for the 1998 MTT-S Microwave Week. The 1998 International Microwave Symposium (IMS) technical papers, panel sessions, interactive forum, workshops and many other activities will acquaint you with the latest technology and advancements in our expanding microwave field. At '98 IMS the breadth of frequencies ranges from HF to light and topics cover 30 technology areas from medical applications to wireless applications. Our theme, "Progress through Microwaves," reflects past accomplishments as well as the explosive expansion of communications through RF wireless technology.



Ed Niehenke

Microwave Week starts on Sunday with three workshops covering RF wireless technology. On Monday, the RF Integrated Circuits (RFIC) Symposium opens and IMS will hold 11 workshops. Tuesday marks the start of the IMS regular sessions and the final day of the RFIC Symposium where IMS/RFIC joint sessions will highlight RF wireless technology. The IMS continues on Wednesday and Thursday with panel sessions at noon each day and an interactive forum each afternoon. On Thursday, there will be two joint sessions with the Automatic RF Techniques Group (ARFTG). ARFTG will hold its conference on Friday and IMS will hold 10 workshops that day to wrap up Microwave Week.

As in the recent years we will hold a student paper contest. The students will present their papers at their normal session. This year, selected student papers will also be presented from 2 to 5 on Tuesday afternoon and 8 to 10 on Wednesday morning at a new student interactive forum. At these times you and the judges will get a chance to talk to the students and see their work. Prizes will be awarded to the authors of the best papers as selected by the judges at the awards banquet Wednesday evening.

The six focused sessions cover: UHF-VHF Power Amplifiers; Microwave and Wireless Education in a Rapidly Changing Environment; Low Power RF/Microwave and Millimeter-wave Wireless Techniques; Optical Beam-forming for Phased Arrays; RF & Microwave Implications of Digital TV Broadcasting; European, US and Japanese Standards; and Historical Perspectives on Microwave Systems.

The 240 members of the Technical Program Committee (TPC) and the 20 members of the local '98 IMS Steering Committee worked diligently in organizing a premier technical program. We would like to acknowledge their excellent work and thank the following local IMS Technical Committee members: Bob Moore and Mike Frankel – Focused Sessions; Shyam Bajpai and Saurabh Dalal – Panel Sessions; Lee Phelps, Tim Lee, Jeff Pond and Pete Stenger – Workshops; Harvey Newman, Dan Buck and Larry Dickens – Interactive Forum; Raymond Meixner – Digest Editor; Eric Funk – CD ROM; Greg Wilkins, Peter Herczfeld, Ron Hooker and Marge Axler – Student Papers; Kawthar Zaki – University Liaison; Roger Westgate and Ramesh Gupta – Transactions Guest Editors.



Denis Webb

We look forward to seeing you at IMS '98 and hope the 1998 Symposium will provide you with the most up-to-date and thorough coverage of microwave and related technologies. Have a wonderful time in Baltimore.

Ed Niehenke
Technical Program Chairman
Denis Webb
Technical Program Vice-Chairman

RFIC SYMPOSIUM

On behalf of the Technical Program Committee, I would like to welcome you to the 1998 IEEE RFIC Symposium. This year has produced an exceptional "vintage" of papers, which reflects the revival of the radio frequency technology and its development in high-growth commercial applications.



We have selected 71 papers out of the more than 140 received by RFIC and IMS. While we have increased the number of selected papers from 1997, we were, unfortunately, unable to accommodate many excellent papers.

Unquestionably, we have seen a major, growing excitement for RF and millimeter-wave technology this year. The papers presented cover a wide range of technology. Not only is the "traditional" MESFET, HBT, HEMT GaAs technology very well represented with papers addressing L-band to millimeter-wave applications, but silicon bipolar and RF CMOS technologies are making major inroads in high-volume commercial applications. We have also seen breakthroughs in the level of integration with papers reporting full RF transceiver integration on a chip.

To provide an overview in the development trend, we have invited five experts from leading technology companies to discuss several key areas. These key areas include technology breakthroughs in the cellular market at large, the Japanese market and millimeter-wave applications, the silicon IC capabilities and the power amplifier IC development for portable applications. This series of invited papers should provide us with a clear picture of how the future of RF technology is shaping up.

The 71 presented papers are grouped into 14 focus sessions on Monday, June 8 and Tuesday, June 9. A whole-day workshop session being held on Sunday, June 7 addresses "Low Cost Si-based Technology for Wireless Applications." A panel session on Monday will provide you with the opportunity to challenge key RF figures of the industry on the topic of "Levels of Integration for RFICs? The One-chip Radio: Realistic Goal or Utter Nonsense?" On Wednesday and Thursday, June 10 and 11, we will also provide joint open forums with IMS.

Thanks to the hard work and dedication of all the authors and the Technical Program Committee members, I am convinced that this 1998 RFIC Symposium will be a very successful one. I am convinced too that you will enjoy the famous Baltimore crab cakes as much as I do.

I am looking forward to seeing you in Baltimore.

Christian Kermarrec, RFIC General Chair

51ST ARFTG CONFERENCE

The telecommunications industry is exploding! This growth rate is being driven by changes in technology, regulation and market forces. Just being in the field is not adequate with today's worldwide competition. Faster, better, cheaper, first to market are more than buzz words. We are challenged to design, build and test in shorter cycles.



For over 25 years, the Automatic Radio Frequency Techniques Group (ARFTG) has focused on one thing: automated RF and microwave measurements. We continue this proud tradition of serving the industry with our conference theme "Characterization of Spread Spectrum Telecommunications Components and Systems."

The technical challenges in the test lab and the production line are noteworthy. The demands on the components, subsystems and systems can be daunting to both the design engineer and the test

engineer alike. The specifications drive test complexity. As the specifications become more detailed and more stringent, tests become more difficult. Automation is frequently the only practical solution to contain test costs. Automation also presents its own challenges. Verifying performance and issues of accuracy are common questions of any measurement system.

ARFTG offers a unique opportunity to "meet and greet" some of the top people in the automated RF and microwave test community. Along with the technical presentations, participants will be given several chances to share ideas, questions and concerns in a peer group environment. An ARFTG conference is more than a meeting, it is an experience. Come see why we have been around for over 25 years. Be part of why we will be around for many more. This is a special opportunity for anyone who works in or around RF/microwave tests.

Check out ARFTG on the Web at <http://www.arftg.org>.

John Gregory Burns
Conference Chairman

EXHIBITION

The exhibition that is part of Microwave Week gives you the opportunity to visit displays from over 375 companies showing the latest products and services available to our industry. A number of new companies will be exhibiting this year in addition to the traditional exhibitors.

In addition, the MTT-S Historical Exhibit will be on the show floor, as will the Microwave Application and Product Seminars, which are in their third year. These seminars have been well received and have been improved and expanded for this year's meeting.



The exhibition is open from 9:00 AM to 5:00 PM on Tuesday and Wednesday and from 9:00 AM to 3:00 PM on Thursday. I hope you will take advantage of this chance to see the largest group of microwave exhibitors at any show in the world.

Harlan Howe, Jr.
Exhibition Manager

PLENARY SESSION

All Symposium registrants and guests are invited to attend the Plenary Session highlighting "Progress through Microwaves." The



Dr. Benjamin Pontano

session will begin with an opening procession by the Rockville High School pipe band to gather the "microwave clan" together in the Scottish tradition of Maryland. Starting at 8:00 AM on Tuesday, June 9, opening remarks



Dr. Arye Rosen

will be made by the IMS chairs and the MTT-S president, followed by two keynote presentations that will focus on the "Progress through Microwaves" theme.

Dr. Benjamin Pontano, president of COMSAT Laboratories, will describe how a new generation of communication satellites will operate with terrestrial networks to provide an advanced personal wireless and broadband communications infrastructure. He will also describe the systems and technologies being developed to realize such a vision, including those needed for the new Ka-band and low earth orbit (LEO) satellite systems.

The second topic spotlights the growing role of microwaves in medicine. Drs. Arye Rosen, Sarnoff Corp./Drexel University and



Dr. Arnold J. Greenspon

Arnold J. Greenspon, Thomas Jefferson Medical College, will describe advances in an RF catheter ablation procedure for the treatment of cardiac arrhythmias. A live, tutorial demonstration of an RF catheter ablation procedure will be presented



Roger Kaul

by Dr. Greenspon via a link to an operating room in Philadelphia.

The role of applying RF/microwaves to the needs of society continues to grow. The two areas of communications and medicine are, and will continue to be, major recipients of "Progress through Microwaves."

Roger Kaul,
Plenary Session Chair

FOCUSED SESSIONS

TU2C: RF & MICROWAVE IMPLICATIONS OF DIGITAL TV BROADCASTING: EUROPEAN, US AND JAPANESE STANDARDS

Date: Tuesday, June 9, 1998

Time: 10:10-11:50 AM

Location: Baltimore Convention Center, Room 314/317

Sponsor: MTT-20, Wireless Communications

Chairman: Gabriele Marzocchi, Digital Broadcasting Technology Association, Italy

Organizers: Gabriele Marzocchi
Terry Oxley, Consultant
John Horton, TRW

Speakers: **Arthur Mason**, NDS Broadcast, UK
Wayne Luplow, Zenith Electronics, USA
Mario Lopriore, ESA-ESTEC, Netherlands
Osamu Yamada, NHK Science & Research Laboratories, Japan

Digital television (DTV) is set to make a commercial impact. Satellite digital broadcasting transmissions have already started in Europe and the US. In Europe, the Digital Video Broadcasting (DVB) collaborative project began approximately five years ago, but now involves some 200 organizations from around the world. Full terrestrial DTV transmissions with the DVB standard in the UK are currently planned to commence this year. The DTV terrestrial standard has been chosen in the US and will totally replace analog TV by 2006. The Integrated Services Digital Broadcasting (ISDB) terrestrial standard has been chosen in Japan. This session will concentrate on the interesting technical evolutions in the systems, which are suited to different transmission environments and density of spectrum use.

TU4C: LOW POWER RF/MICROWAVE AND MILLIMETER-WAVE WIRELESS TECHNOLOGIES

Date: Tuesday, June 9, 1998

Time: 3:30-5:10 PM

Location: Baltimore Convention Center, Room 314/317

Sponsors: MTT-15, Microwave Field Theory
MTT-7, Microwave and Millimeter-wave Solid-state Devices

Chairman: James Harvey, Army Research Office

Organizer: Tatsuo Itoh, UCLA

Speakers: **James Harvey**
Robert Trew, DDR&E
Wayne Stark, University of Michigan
Peter Asbeck, University of California, San Diego
Linda Katehi, University of Michigan
J. Mike Golio, Rockwell International

Reduction of DC power consumption in an RF/microwave wireless environment requires much more than the design of an amplifier with high power-added efficiency. This session will address emerging interdisciplinary efforts in the research for low power wireless design in communication, radar and sensing. Papers presented will deal with innovative solid-state devices, new and efficient circuit and antenna structures, communication systems aspects, power control, innovative modulation schemes and top-down design methodology. How these technologies are interactively used and leveraged with each other also will be discussed.

WE1B: HISTORICAL PERSPECTIVES ON MICROWAVE SYSTEMS IN THE BALTIMORE/WASHINGTON AREA

Date: Wednesday, June 10, 1998

Time: 8:00-9:40 AM

Location: Baltimore Convention Center, Room 309/310

Chairman: Merrill Skolnik

Organizers: Merrill Skolnik
Warren Cooper

Speakers: **Gene Strull**, Westinghouse, retired
Charles M. Johnson, Mitre Corp.
Geoffrey Hyde, COMSAT Corp., retired
Louis Brown, Department of Terrestrial Magnetism (DTM), retired

The development of microwave technology in the Baltimore area began its tremendous growth from a laboratory curiosity to the implementation of new and important systems early in World War II. There has been a significant focus on the use of microwaves in this region ever since. After an overview by the chairman, speakers will describe advances in airborne pulse Doppler radars and AWACS at Westinghouse, and pioneering developments in millimeter-wave radars and radiometers (up to 600 GHz) at Electronic Communications Inc. and Army Research Laboratory, including early work on phased-array radars. The development of the proximity fuse by DTM, APL and DOFL led to the significant improvements in artillery. Commercial and new nonmilitary applications for space will be highlighted, including the accomplishments of COMSAT, APL and NASA Goddard.

**WE2B: MICROWAVE AND WIRELESS EDUCATION
IN A RAPIDLY CHANGING ENVIRONMENT**

Date: Wednesday, June 10, 1998
Time: 10:10–11:50 AM
Location: Baltimore Convention Center, Room 309/310
Sponsors: MTT-16, Microwave Systems
 MTT-20, Communication Systems
Chairman: Robert Caverly, Villanova University
Organizers: Robert Caverly
 George Heiter, Analog Devices
Speakers: **L. Besser**, Besser Associates, USA
A. Beyer, University of Duisburg, Germany
H. Hartnagel, Technical University
 of Darmstadt, Germany
W. Hoefer, University of Victoria, Canada
J. Hwang, Lehigh University, USA
T. Weller, of University of South Florida, USA

The rapid changes in the wireless and microwave markets have required that educators around the globe develop innovative strategies to educate the next generation of microwave and wireless engineers. Specifically, this environment demands an understanding of both theoretical background as well as practical knowledge in circuit design. This focused session will address issues that arise in developing educational programs and present some innovative solutions. The speakers will present representative solutions aimed at educating engineers in terms of both entering and continuing education programs.

WE4C: HF/VHF/UHF POWER AMPLIFIERS

Date: Wednesday, June 10, 1998
Time: 3:30–5:10 PM
Location: Baltimore Convention Center, Room 314/317
Sponsor: MTT-17, HF-UHF Technology
Chairmen: Frederick H. Raab, GMRR
 H. Clark Bell, HF+
Organizers: Frederick H. Raab
 H. Clark Bell

Speakers: **D. Myer**, Communication Power
R. Frey, Advanced Power Technology
J.F. Davis and **D.B. Ruteledge**, Caltech
N.O. Sokal, Design Automation
R.L. Campbell, TriQuint Semiconductor

This session focuses on RF power amplifiers for the HF, VHF and UHF bands where both applications (for example, the plasma driver) and technology (for example, ferrite beads and MOSFETs) often differ significantly from their microwave counterparts. The five papers will present broad overviews or detailed discussions of advancements in the state of the art in areas where there is currently considerable interest. The topics include feedforward amplifiers; outphasing (LINC) amplifiers; driving plasma and laser loads; low-cost RF power MOSFETs; low-cost, class-E amplifiers; capabilities of class-E amplifiers from HF through microwave; and combining techniques.

TH2C: OPTICAL BEAM-FORMING FOR PHASED ARRAYS

Date: Thursday, June 11, 1998
Time: 10:10–11:50 AM
Location: Baltimore Convention Center, Room 314/317
Sponsors: MTT-S, Lightwave Technology
 MTT-16, Microwave Systems
Chairman: Alwyn J. Seeds, University College, London
Organizer: Alwyn J. Seeds
Speakers: **R.D. Esman**, NRL
Harold Fetterman, UCLA
Osamu Shibata, ATR, Japan
Robert Minasian, University of Sydney, Australia
Javier Marti, ETSI, Spain
W.R. Peal, UCLA
Yian Chang, UCLA

The need for multifunction, conformal and wideband phased-array antennas has led to considerable interest in the use of optical beam-forming techniques. These techniques offer several advantages over conventional approaches. First, they enable the beam-forming function to be remoted from the array face, facilitating conformal applications and easing packing density and thermal management problems. Second, they are inherently wideband, simplifying the approach to multifunction arrays. Finally, they offer relatively simple techniques for achieving true time-delay beam-forming, making possible simultaneous multiband operation and advanced imaging capability. A wide range of optical beam-forming techniques have been developed and several have been implemented in demonstrator phased arrays. The object of this focused session is to bring together leading researchers from around the world to present the current state of the art in optical beam-forming for phased-array applications and to review this information against known system requirements and constraints. Topics to be addressed will include system requirements for advanced beam-formers for communications and radar phased arrays, coherent optical beam-formers, fibre-grating-based true time-delay beam-formers, fibre-prism-based beam-formers, two-dimensional optics in optical beam-forming and system demonstrations.

1998 MTT-S WORKSHOPS

	<i>Number</i>	<i>Time</i>	<i>Title</i>
Sunday June 7	WSA	8 AM–5 PM	Wireless Local Loop Systems: Technologies, Opportunities and Market
	WSB	8 AM–5 PM	Low Cost Si-based Technology for Wireless Applications
	WSC	8 AM–5 PM	Comparison of the Various MCM Technologies for Microwave Multichip Assemblies
Monday June 8	WMA	8 AM–5 PM	Computer-aided Design, Electromagnetic Modeling and Measurement for Electronics Packaging and Interconnects
	WMB	8 AM–5 PM	Microwave/Lightwave Methods for Indoor and Outdoor Wireless and Mobile Communication
	WMC	8 AM–5 PM	Low Cost Digital and Analog Optoelectronic Modules: Manufacturing and Systems Insertion
	WMD	8 AM–5 PM	Advances in Amplifier Linearization
	WME	8 AM–5 PM	Multilayer Microwave Circuits
	WMF	8 AM–12 PM	Accurate Dielectric Characterization of PWB Substrates
	WMG	8 AM–12 PM	Cryogenics: A New Beginning
	WMH	8 AM–12 PM	Integration of Ferrite Devices into Future Radar, Wireless and Space Systems
	WMI	1 PM–5 PM	Analog-to-digital Converters for Digital Receiver Systems
	WMJ	1 PM–5 PM	Technologies for Tunable Microwave Systems
	WMK	1 PM–5 PM	IMT-2000: What is It and What is in It for the Microwave Community?
Friday June 12	WFA	8 AM–5 PM	Designing RF Receivers for Wireless Systems
	WFB	8 AM–5 PM	High Frequency Silicon Micromachining and Multichip Integration
	WFC	8 AM–5 PM	The Emergence of Millimeter-wave Video-on-demand Systems
	WFD	8 AM–5 PM	Computer-aided Design for Manufacturability
	WFE	8 AM–5 PM	Comparative Filter Technologies for Communications Systems
	WFF	8 AM–5 PM	High Power MMIC Amplifiers
	WFG	8 AM–12 PM	New Developments in Time Domain Methods for Nonlinear Design
	WFH	8 AM–12 PM	Novel Approaches to Photonic-antenna Integration
	WFI	1 PM–5 PM	Product Development through Foundries
	WFJ	1 PM–5 PM	Antenna Technology for Wireless Applications

The 1998 IMS offers 24 workshops to allow the working engineer to keep abreast of the most current developments in technology. Tutorials, working forums and demonstrations of the latest techniques being used in industry will be presented by the experts. Critical issues associated with both emerging markets and improved technologies that impact business decisions and new markets can be explored. Workshop participants are encouraged to participate in interactive exchanges of ideas with other experienced professionals.

All registrants will be provided with published notes of the presenters, a continental breakfast (morning and full-day workshops), lunch (all workshops) and refreshments during breaks. Plan to register and pick up workshop materials in advance.

Detailed descriptions as well as a list of presenters, scheduled times and brief format information are given on pages 14–18 and 49–52. An overview of the topics and times can be referenced in the workshop schedule printed above.

MTT-S PANEL SESSIONS

The 1998 Symposium features six lunchtime (12:00–1:15 PM) panel sessions throughout the week, which are intended to foster lively, interactive discussions of exciting and timely topics. These sessions will take place in the Baltimore Convention Center and include lunch.

The following topics will be discussed:

MONDAY, JUNE 8

- Levels of Integration for RFICs?
- The One-chip Radio: Realistic Goal or Utter Nonsense?

TUESDAY, JUNE 9

- Key Policy Issues in Microwave Spectrum Management
- Future Research Directions in Microwave CAD

WEDNESDAY, JUNE 10

- Microelectromechanical Systems (MEMS) for Microwave and Millimeter-wave Applications

THURSDAY, JUNE 11

- Reliability Without Hermiticity (RWOH)
- Advanced Multifunctional RF Systems (AMRFS)

Participation in the panel sessions requires separate registration; please use the registration form on page 7. Detailed descriptions of the panel sessions can be found on page 19 for Monday and Tuesday, and page 27 for Wednesday and Thursday panel sessions, respectively.

Advance Conference Registration

1998 IEEE MTT-S MICROWAVE WEEK EVENTS

June 7-12, 1998 ♦ Baltimore, MD ♦ IMS ♦ RFIC ♦ ARFTG

Each Conference Attendee must submit a separate registration form. A copy of this form may be used.
The deadline for advanced registration is May 15, 1998. Afterwards, on-site fees apply.
On-site fees will be approximately 30% higher.

NAME Last First

AFFILIATION Company, Etc. Mail Stop

ADDRESS Street

City State Postal Code Country

e-mail Address

US/CANADA TEL. INT'L TEL.

IEEE MEMBER ☐ Yes ☐ No ☐ IEEE Membership No. * MTT-S MEMBER ☐ Yes ☐ No

Name of Guest ARFTG MEMBER ☐ Yes ☐ No

*Must be given to qualify for member discount

To register, check ☒ the appropriate boxes and enter corresponding fees in the Remittance column.

➤ **INT. MICROWAVE SYMPOSIUM**
Tue., Wed. & Thur.
 All IMS Sessions (Includes IMS CD ROM and Digest.) ☐ \$235 ☐ \$340 \$ _____
 All IMS Sessions (Includes IMS CD ROM, *no* Digest.) ☐ \$165 ☐ \$250 \$ _____
 Single-Day Registration ☐ \$105 ☐ \$150 \$ _____
 (Includes IMS CD ROM, *no* Digest.)
 Student, Retiree, Life Member ☐ \$ 35 ☐ \$ 40 \$ _____
 (Includes IMS CD ROM, *no* Digest.)

➤ **RFIC SYMPOSIUM** ☐ \$ 85 ☐ \$110 \$ _____
Sun., Mon. & Tue. (Includes RFIC Reception and RFIC Digest.)

➤ **ARFTG-AUTOMATIC RF TECHNIQUES CONFERENCE**
Fri. (Includes breakfast, lunch, ARFTG Digest and ARFTG Exhibition.)
 ARFTG Member ☐ \$130 \$ _____
 ARFTG Non-member ☐ \$155 \$ _____
 ARFTG Student, Retiree ☐ \$ 65 \$ _____

➤ **ADDITIONAL DIGESTS AND CD ROMS**
 IMS Digest Qty. ____ @ ☐ \$ 70 ☐ \$ 90 \$ _____
 IMS CD ROM Qty. ____ @ ☐ \$ 20 ☐ \$ 30 \$ _____
 RFIC Digest Qty. ____ @ ☐ \$ 35 ☐ \$ 50 \$ _____
 ARFTG Digest
 Member Qty. ____ @ ☐ \$ 20 \$ _____
 Non-member Qty. ____ @ ☐ \$ 45 \$ _____

➤ **PANEL SESSIONS** (Includes box lunch. See reverse side for schedule.)
 PMON1: Levels of Integration for RFICs ☐ \$15 \$ _____
 PTUE2: Key Policy Issues ☐ \$15 \$ _____
 in Microwave Spectrum Management
 PTUE3: Research Directions in Microwave CAD ☐ \$15 \$ _____
 PWED4: Microelectromechanical Systems (MEMS) ☐ \$15 \$ _____
 for Microwave and Millimeter-wave
 Applications
 PTHU5: Reliability Without Hermiticity ☐ \$15 \$ _____
 PTHU6: Advanced Multifunctional ☐ \$15 \$ _____
 RF Systems (AMRFS)

➤ **Maryland Crab Feast** (Tuesday Evening) Qty. ____ @ ☐ \$20 \$ _____

➤ **AWARDS BANQUET** (Wednesday Evening, Hyatt) Qty. ____ @ ☐ \$40 \$ _____

➤ **EXHIBITION ONLY** ☐ \$10 \$ _____

➤ **WORKSHOPS** (See pages 14-18 and 49-52 for descriptions.)

	Regular Rate	Student/Retiree/ Life Member
Full Day	\$80	\$55
Half Day	\$50	\$35
SUNDAY		FRIDAY
<input type="checkbox"/> WSA (Full Day) \$ _____		<input type="checkbox"/> WFA (Full Day) \$ _____
<input type="checkbox"/> WSB (Full Day) \$ _____		<input type="checkbox"/> WFB (Full Day) \$ _____
<input type="checkbox"/> WSC (Full Day) \$ _____		<input type="checkbox"/> WFC (Full Day) \$ _____
MONDAY		<input type="checkbox"/> WFD (Full Day) \$ _____
<input type="checkbox"/> WMA (Full Day) \$ _____		<input type="checkbox"/> WFE (Full Day) \$ _____
<input type="checkbox"/> WMB (Full Day) \$ _____		<input type="checkbox"/> WFF (Full Day) \$ _____
<input type="checkbox"/> WMC (Full Day) \$ _____		<input type="checkbox"/> WFG (Morning) \$ _____
<input type="checkbox"/> WMD (Full Day) \$ _____		<input type="checkbox"/> WFH (Morning) \$ _____
<input type="checkbox"/> WME (Full Day) \$ _____		<input type="checkbox"/> WFI (Afternoon) \$ _____
<input type="checkbox"/> WMF (Morning) \$ _____		<input type="checkbox"/> WFJ (Afternoon) \$ _____
<input type="checkbox"/> WMG (Morning) \$ _____		
<input type="checkbox"/> WMH (Morning) \$ _____		
<input type="checkbox"/> WMI (Afternoon) \$ _____		
<input type="checkbox"/> WMJ (Afternoon) \$ _____		
<input type="checkbox"/> WMK (Afternoon) \$ _____		
		Total for all WORKSHOPS
		\$ _____

Full-day workshops include continental breakfast, lunch and afternoon refreshments.
 Morning workshops include continental breakfast and lunch.
 Afternoon workshops include lunch and afternoon refreshments.
 All workshop registrations include a bound copy of the presenter's notes.

➤ **GUEST PROGRAMS** (See page 62 for complete information.)
 GA: Baltimore: Stars, Stripes Qty. ____ @ ☐ \$50 \$ _____
 and Special Sights (Tues., 9 AM-4 PM)
 GB: Annapolis: A Town of Three Centuries (Wed., 9 AM-3 PM) Qty. ____ @ ☐ \$50 \$ _____
 GC: Washington, DC: Qty. ____ @ ☐ \$50 \$ _____
 Our Nation's Capital (Thur., 8 AM-4 PM)

The only acceptable forms of payment are check, money order, MasterCard or VISA.

➤ Make your check or money order (US \$ ONLY on a US Bank or Traveler's Check) payable to:
"IMS Registration" ■ Or charge your MasterCard or VISA:
☐ MasterCard ☐ VISA

TOTAL REMITTANCE \$ _____
INDIVIDUAL PAYMENT MUST ACCOMPANY FORM

Card #
 Signature

Exp. Date

➤ Written requests for a refund will be honored if received by May 15, 1998.
 A \$25 cancellation fee will be charged for processing.

MAIL COMPLETED FORM AND PAYMENT TO:

1998 IMS Registration, PO Box 3471, Boston, MA 02241-3471, USA • FAX: (781) 828-9992.

For information or phone registration call (888) 397-6208.

If this form is sent by FAX do NOT also mail; a credit card number & signature, or a check or money order in US dollars must be included.

PLEASE FAX OR MAIL; DO NOT FORWARD HARD COPY IF FAXED

REGISTRATION IS ALSO AVAILABLE ON THE WORLD WIDE WEB AT www.expo-intl.com/shows/mtt-s/register

WORKSHOPS

	Number	Time	Title
Sunday June 7	WSA	8 AM–5 PM	Wireless Local Loop Systems: Technologies, Opportunities and Market
	WSB	8 AM–5 PM	Low Cost Si-based Technology for Wireless Applications
	WSC	8 AM–5 PM	Comparison of the Various MCM Technologies for Microwave Multichip Assemblies
Monday June 8	WMA	8 AM–5 PM	Computer-aided Design, Electromagnetic Modeling and Measurement for Electronics Packaging and Interconnects
	WMB	8 AM–5 PM	Microwave/Lightwave Methods for Indoor and Outdoor Wireless and Mobile Communication
	WMC	8 AM–5 PM	Low Cost Digital and Analog Optoelectronic Modules: Manufacturing and Systems Insertion
	WMD	8 AM–5 PM	Advances in Amplifier Linearization
	WME	8 AM–5 PM	Multilayer Microwave Circuits
	WMF	8 AM–12 PM	Accurate Dielectric Characterization of PWB Substrates
	WMG	8 AM–12 PM	Cryogenics: A New Beginning
	WMH	8 AM–12 PM	Integration of Ferrite Devices into Future Radar, Wireless and Space Systems
	WMI	1 PM–5 PM	Analog-to-digital Converters for Digital Receiver Systems
	WMJ	1 PM–5 PM	Technologies for Tunable Microwave Systems
	WMK	1 PM–5 PM	IMT-2000: What is It and What is in It for the Microwave Community?
Friday June 12	WFA	8 AM–5 PM	Designing RF Receivers for Wireless Systems
	WFB	8 AM–5 PM	High Frequency Silicon Micromachining and Multichip Integration
	WFC	8 AM–5 PM	The Emergence of Millimeter-wave Video-on-demand Systems
	WFD	8 AM–5 PM	Computer-aided Design for Manufacturability
	WFE	8 AM–5 PM	Comparative Filter Technologies for Communications Systems
	WFF	8 AM–5 PM	High Power MMIC Amplifiers
	WFG	8 AM–12 PM	New Developments in Time Domain Methods for Nonlinear Design
	WFH	8 AM–12 PM	Novel Approaches to Photonic-antenna Integration
	WFI	1 PM–5 PM	Product Development through Foundries
	WFJ	1 PM–5 PM	Antenna Technology for Wireless Applications

PANEL SESSIONS

12:00 NOON TO 1:15 PM

	PMON1	Monday	Levels of Integration for RFICs? The One-chip Radio: Realistic Goal or Utter Nonsense?
	PTUE2	Tuesday	Key Policy Issues in Microwave Spectrum Management
	PTUE3	Tuesday	Research Directions in Microwave CAD
	PWED4	Wednesday	Microelectromechanical Systems (MEMS) for Microwave and Millimeter-wave Applications
	PTHU5	Thursday	Reliability Without Hermiticity
	PTHU6	Thursday	Advanced Multifunctional RF Systems (AMRFS)

SOCIAL EVENTS

Tuesday	6:30–9:00 PM	Maryland Crab Feast
Wednesday	7:30–10:00 PM	Awards Banquet

GUEST PROGRAMS

Tuesday	GA	9:00 AM–4:00 PM	Baltimore: Stars and Stripes and Special Sights
Wednesday	GB	9:00 AM–3:00 PM	Annapolis: A Town of Three Centuries
Thursday	GC	8:00 AM–4:00 PM	A Day in Washington, DC

CONFERENCE HOUSING 1998 IEEE MTT-S INTERNATIONAL MICROWAVE SYMPOSIUM



June 7–12, 1998 • Baltimore, MD

MTT-S • RFIC • ARFTG

Reservations may be made by phone, fax or mail and must be received by the Housing Bureau by May 11, 1998.

Phone:
(800) 800-9230

Fax this form to:
(301) 210-1182

OR

Mail this form to:
MTDB/BACVA Housing Bureau, 12051 Indian Creek Court, Beltsville, MD 20705

INSTRUCTIONS AND HOUSING BUREAU POLICY

1. Please print or type all data requested.
2. Reservations will be processed on a first-come, first-served basis.
3. All reservations require a \$150.00 deposit paid by check or guaranteed by credit card.
4. Phone and Fax reservations must provide credit card information. Checks provided for mail reservations should be made out to BACVA Housing Bureau.
5. You will receive an acknowledgment of your reservation from the Housing Bureau 7–10 days after your reservation is received.
6. Changes and cancellations prior to May 11 must go through the Housing Bureau.
7. Changes after May 11 must be made with your hotel.
8. Hotel cancellation policies vary. Generally, cancellations received by hotels at least 72 hours prior to scheduled arrivals qualify for deposit refunds, but you should check with your hotel to verify its policy.

HOTEL PREFERENCE

Hotel locations and rates are shown on the reverse side of this form.

Please write full name of hotel and show at least three choices.

First choice _____ Third choice _____

Second choice _____ Fourth choice _____

If hotel choices are unavailable, which is most important: Rate _____ or Location _____ (please select one)

Name _____
First Last

Company _____

Address _____

City _____ **State/Province** _____ **ZIP/Postal Code** _____

Country _____ **Daytime Phone** () _____ **or FAX** () _____
w/Int'l Country Code

Deposit paid by: ☐ Check or Money Order ☐ MasterCard ☐ Visa ☐ American Express ☐ Check

CARDHOLDER NAME (printed) _____

CARDHOLDER SIGNATURE _____

CARD NO. _____ **EXP. DATE** _____

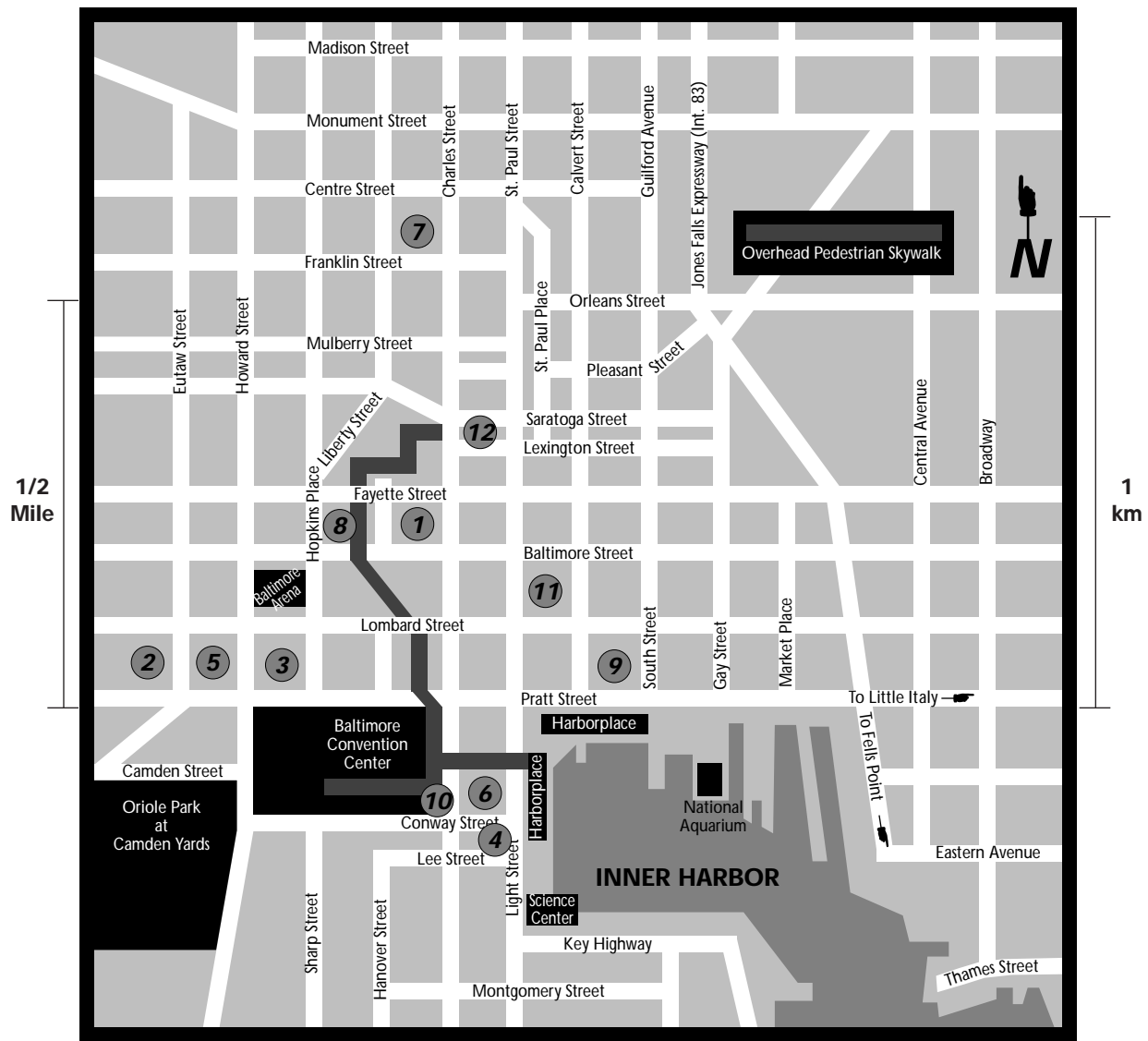
ROOM OCCUPANTS

1. Print or type names of persons occupying each room. If more than three rooms are required, attach a list providing the information requested below for each additional room.
2. Select room type desired, indicate arrival and departure dates, and special requests (not guaranteed).

Occupants (first name first)

ROOM NO. 1	1.	Check one: <input type="checkbox"/> Single <input type="checkbox"/> Double (1 bed) <input type="checkbox"/> Dbl/Dbl (2 dbl beds) <input type="checkbox"/> Govt. Arr. Date: _____ Dep. Date: _____
	2.	Requests: <input type="checkbox"/> Smoking <input type="checkbox"/> Non-Smoking <input type="checkbox"/> Wheelchair Accessible <input type="checkbox"/> King
ROOM NO. 2	1.	Check one: <input type="checkbox"/> Single <input type="checkbox"/> Double (1 bed) <input type="checkbox"/> Dbl/Dbl (2 dbl beds) <input type="checkbox"/> Govt. Arr. Date: _____ Dep. Date: _____
	2.	Requests: <input type="checkbox"/> Smoking <input type="checkbox"/> Non-Smoking <input type="checkbox"/> Wheelchair Accessible <input type="checkbox"/> King
ROOM NO. 3	1.	Check one: <input type="checkbox"/> Single <input type="checkbox"/> Double (1 bed) <input type="checkbox"/> Dbl/Dbl (2 dbl beds) <input type="checkbox"/> Govt. Arr. Date: _____ Dep. Date: _____
	2.	Requests: <input type="checkbox"/> Smoking <input type="checkbox"/> Non-Smoking <input type="checkbox"/> Wheelchair Accessible <input type="checkbox"/> King

HOTEL INFORMATION



1998 IMS CONFERENCE HOTELS

MAP No.	HOTEL	SINGLE	DOUBLE	TRIPLE/QUAD	
1	Baltimore Hilton & Towers	\$134	\$148	\$168/\$188	
2	Baltimore Marriott Inner Harbor	\$149	\$159	\$169/\$179	G
3	Days Inn Inner Harbor	\$102	\$112	\$122/\$132	G
4	Harbor Court Hotel	\$160	\$160	\$175/\$190	
5	Holiday Inn	\$115	\$125	\$125/\$125	G
6	Hyatt Regency Baltimore (Headquarters)	\$155	\$170	\$195/\$220	G
7	Mount Vernon Hotel	\$ 75	\$ 85	\$ 85	G
8	Omni Inner Harbor Hotel	\$129	\$129	\$149/\$169	G
9	Renaissance Harbor Place	\$165/\$205	\$165/\$205	\$185/\$225	
10	Sheraton Inner Harbor	\$159	\$159	\$174/\$189	
11	The Brookshire Suite Hotel	\$159	\$179	\$199/\$219	
12	Tremont Plaza	\$125	\$125	\$145	

G Special rates available for US government employees with travel orders

REGISTRATION

REQUIREMENTS

Registration fees are required of all participants, including session chairs, authors, and workshop and panel session organizers and speakers.

ADVANCE REGISTRATION

Reduced rates are offered for advanced registration, with a deadline of May 15, 1998. A registration form is available on page 7 of this program. Each registrant must submit a separate form, with payment, to the address shown at the bottom of the registration form. When using a credit card, fax, telephone and World Wide Web registration are available, although no international telephone number is available. When mailing, please mail early to ensure receipt by the deadline; otherwise, on-site fees will apply.

Individual remittance must accompany the registration form and is payable in US dollars only using personal check, traveler's check, international money order or credit card (VISA or MasterCard only). Personal checks must be encoded at the bottom with the bank number, account number and check number. Bank drafts and cash are unacceptable and will be returned. Note that a foreign check or money order may be subject to a substantial handling charge by the correspondent bank in the US. This charge will be deducted from your payment; any shortage must be paid at on-site check-in.

GUEST REGISTRATION

To preregister your guest, include his or her name on your registration form. For additional guests, submit additional registration forms, including your name on each. Guest badges will be included in the envelope that you will receive upon check-in. On-site guest registration will also be available.

STUDENTS, RETIREES AND LIFE FELLOWS

Students, Retirees and IEEE Life Fellows receive a substantial discount on the IMS registration fee. Digests are not included. To qualify as a student, a registrant must be either a student member of IEEE or a full-time student carrying a course load of at least nine credit hours. ARFTG provides discounts for students and retirees.

PRESS REGISTRATION

Credentialed press representatives are welcome to register without cost and thereby have access to technical sessions and exhibits. Digests are not included.

ON-SITE REGISTRATION

On-site registration for all Microwave Week events will be available at the Baltimore Convention Center, Pratt Street Lobby. Registration hours are:

Sunday, June 7	2:00 PM–9:00 PM
Monday, June 8	7:00 AM–5:00 PM
Tuesday, June 9	7:00 AM–5:00 PM
Wednesday, June 10	7:00 AM–5:00 PM
Thursday, June 11	7:00 AM–5:00 PM

ON-SITE WORKSHOP REGISTRATION

On-site registration for Sunday Workshops *only* will be available on Sunday morning at the Convention Center (Pratt Street Lobby) from 7–9 AM. If possible, please preregister. Preregistrants may pick

up their full Microwave Week registration packet at this time; on-site registrants will need to return during the regular registration hours listed previously.

On-site registration for Friday Workshops *only* will be available on Friday morning at the Convention Center (Pratt Street Lobby). Registration hours are 7–9 AM. If possible, please preregister or use the Convention Center registration desk earlier in the week.

ON-SITE ARFTG REGISTRATION

Beginning Friday morning at 7:30 AM, on-site ARFTG registration will be available at the Convention Center. If possible, please preregister or use the Convention Center registration desk (Pratt Street Lobby) earlier in the week.

ON-SITE REGISTRATION FEES

	IEEE Member	Non- Member
Int'l Microwave Symposium		
All IMS Sessions (Includes IMS CD ROM and Digest.)	\$310	\$420
All IMS Sessions (Includes IMS CD ROM, <i>no</i> Digest.)	\$240	\$330
Single-Day (Includes IMS CD ROM, <i>no</i> Digest.)	\$135	\$195
Student, Retiree, Life Member (Includes IMS CD ROM, <i>no</i> Digest.)	\$45	\$55
RFIC Symposium	\$105	\$130
ARFTG Conference		
ARFTG Member	\$160	\$160
ARFTG Non-member	\$185	\$185
ARFTG Student/Retiree	\$80	\$80
Additional Digests and CD ROMs		
IMS Digest	\$70	\$90
IMS CD ROM	\$20	\$30
RFIC Digest	\$35	\$50
ARFTG Digest		
ARFTG Member	\$20	\$20
ARFTG Non-member	\$45	\$45
Panel Session	\$20	\$20
Maryland Crab Feast	\$25	\$25
(Space is limited; tickets must be purchased by noon on Tuesday.)		
Awards Banquet	\$40	\$40
Exhibition Only	\$10	\$10
Guest Programs		
GA (Baltimore)	\$50	\$50
GB (Annapolis)	\$50	\$50
GC (Washington, DC)	\$50	\$50

Workshops	Regular Rate	Student, Retiree, Life Member
Full Day	\$100	\$70
Half Day	\$65	\$45

REFUND POLICY

Refund requests received by May 15, 1998 will be honored but will be subject to a \$25 service charge. For requests received after this date, preregistrants will, in lieu of a refund, be mailed any digests due. In either case, please state the preregistrant's name and provide a mailing address for the refund check. Address your request to:

Mr. Gus Bontzos
1998 IEEE MTT-S IMS Registration Chairman
PO Box 18507
Baltimore, MD 21240

RFIC SCHEDULE

The 1998 RFIC Symposium will be held in the Baltimore Convention Center (BCC) in conjunction with the 1998 International Microwave Symposium. Sessions open to attendees of both symposia include the workshop on Sunday, the joint sessions on Tuesday and the Interactive Forum on Wednesday.

SUNDAY, JUNE 7, 1998

- 7:00 AM–9:00 AM Workshop Registration
- 8:00 AM–5:00 PM Workshop WSB—Low Cost Si-based Technology for Wireless Applications
- 2:00 PM–9:00 PM RFIC Registration—BCC
- 7:00 PM–10:00 PM RFIC Reception—Hyatt Regency

MONDAY, JUNE 8, 1998

- 7:00 AM–5:00 PM RFIC Registration—BCC
- 7:00 AM–8:00 AM Speakers' Breakfast—BCC Ballroom
- 7:00 AM–5:00 PM Speakers' Preparation—BCC, Room 313
- 8:00 AM–5:00 PM Technical Sessions—BCC
- 12:00 PM–1:15 PM RFIC Panel Lunch—Levels of Integration for RFICs? The One-chip Radio: Realistic Goal or Utter Nonsense?—BCC
- 6:00 PM–10:00 PM *Microwave Journal* Reception—Maryland Science Center

TUESDAY, JUNE 9, 1998

- 7:00 AM–8:00 AM Speakers' Breakfast—BCC Ballroom
- 10:10 AM–5:10 PM Technical Sessions
(Joint with IMS)—BCC 309/310 and 318/323

MONDAY

MESSAGE FROM THE RFIC SYMPOSIUM GENERAL CHAIRMAN

On behalf of the Steering Committee, it is my pleasure to welcome you to the 1998 IEEE Radio Frequency Integrated Circuits (RFIC) Symposium. This is the second year of this new and exciting symposium that focuses on highly integrated ICs and subsystems.

This new symposium was formed to bring to focus the technical accomplishments in RF integrated circuits. Recent advancements in RFICs suitable for wireless and other communication applications are highlighted at this symposium. The technical program is complemented by social activities to relax, meet your peers and have informal technical discussions.

We start the technical activities on Sunday with a workshop on low cost, silicon-based RFICs. Technical sessions on Monday and Tuesday include commercial and military applications of highly integrated ICs. Monday's panel session examines the viability of a single-chip radio.

The symposium kicks off with an invited session on wireless communication IC trends. RFICs are the building blocks of many wireless communication systems. Higher levels of integration achieved by improved design methodology have enabled the development of cost-effective solutions for portable communication systems. This year's symposium highlights the technical accomplishments in silicon and GaAs RFICs in low power receivers, high efficiency transmitters, cordless telephones, etc. The second day of the symposium, held jointly with the 1998 International Microwave Symposium, highlights the advancement in microwave and millimeter-wave ICs developed for commercial and military applications.

The RFIC social program will include the traditional reception held on Sunday evening and the *Microwave Journal* Reception on Monday evening. On Tuesday, RFIC attendees also will be able to visit the exhibit booths displaying a wide variety of RF and microwave products and services.

The technical program put together by the Program Committee is truly outstanding. The significant increase in the number papers submitted this year resulted in the selection of the best of the best among papers discussing RF, microwave and millimeter-wave ICs.

Come and experience the exciting RFIC Symposium in Baltimore!

Vijay Nair, 1998 RFIC General Chairman

1998 RFIC TECHNICAL PROGRAM

Monday, June 8, 1998 - Baltimore Convention Center

Session I Wireless Communication ICs: Trends and Challenges - Room 307/309

Invited Session

Chair: C. Kermarrec, Analog Devices

Co-chair: V. Nair, Motorola

8:00 AM I-1: Welcome and Introductions

Vijay Nair, Motorola Inc.; Chris Kermarrec, Analog Devices

8:30 AM I-2: Wireless Communications Devices and Technology: Future Directions

K. Hansen, Radio Products Group, Motorola Inc., Plantation, FL

9:00 AM I-3: RF Design Challenges for CDMA Cellular and PCS Handsets

F. Ali, Nokia Mobile Phones, R&D Center, San Diego, CA

9:30 AM I-4: Recent Trends and Status of Japanese RFICs for Commercial Applications

H. Kondoh, Hitachi Ltd., Central Research Lab., Tokyo, Japan

Session II Coplanar mm-wave MMICs - Room 341/342

Chair: J.P. Mondal, Northrop Grumman

Co-chair: L.C.T. Liu, TRW

10:30 AM II-1: K-Band Si/SiGe HBT MMIC Amplifiers Using Lumped Passive Components with a Micromachined Structure

L.-H. Lu, J.-S. Rieh, P. Bhattacharya, L.P.B. Katehi, Dept. of Elect. Engr. and Comp. Science, Univ. of Michigan, Ann Arbor, MI

10:50 AM II-2: A 1-157 GHz InP HEMT Traveling-wave Amplifier

B. Agarwal, M.J.W. Rodwell, Dept. of Elect. and Comp. Engr., Univ. of California, Santa Barbara, CA; A.E. Schmitz, J.J. Brown, M. Le, M. Lui, Hughes Research Labs, Malibu, CA;

11:10 AM II-3: 76 GHz Flip-chip MMICs for Automotive Radars

T. Shimura, Y. Kawasaki, Y. Ohashi, K. Shirakawa, T. Hirose, S. Aoki, H. Somet, K. Makiyama, Fujitsu Labs. Ltd., Kawasaki, Japan; S. Yokokawa, Fujitsu Quantum Devices Ltd., Atsugi, Japan

11:30 AM II-4: An 18-40 GHz Monolithic Ring Mixer

S.A. Maas, Nonlinear Technologies Inc., Long Beach, CA; F. Yamada, A. Oki, TRW Electronic Systems Group, Redondo Beach, CA; N. Matovelle, C. Hochuli, Naval Research Lab., Washington, DC

11:50 AM II-5: Coplanar Transceiver MMIC for 77 GHz Automotive Applications Based on a Nonlinear Design Approach

L. Verwey, M. Neumann, R. Osorio, S. Kudszus, H. Massler, W. Reinert, A. Hülsmann, W. Haydl, M. Schlechtweg, Fraunhofer Inst. Freiburg, Germany; H.J. Siweris, U. Schaper, W. Werthof, H. Tisher, W. Kellner, Siemens Corp.; T. Meier, Siemens Semicon., Munich, Germany

Session III Single Function GaAs ICs - Room 339/340

Chair: C. Kermarrec, Analog Devices

Co-chair: A. Adar, Anadigics

10:30 AM III-1: Highly Selective Novel MMIC Microwave Active Recursive Filter

W. Mouzannar, L. Billonnet, B. Jarry, P. Guillon, ICOM - Univ. of Limoges, Limoges, France

10:50 AM III-2: A High Performance Switched-LNA IC for CDMA Handset Receiver Applications

R. Moroney, K. Harrington, W. Struble, B. Khabbaz, M. Murphy, D. Carr, M/A-COM, Integrated Semiconductor Business Unit, Lowell, MA

11:10 AM III-3: A Low Noise Amplifier for a Multi-band and Multi-mode Handset

C.-S. Lee, M.-G. Kim, J.-J. Lee, K.-E. Pyun, H.-M. Park, Compound Semiconductor Dept., Elec. and Telecom. Research Inst., Taejeon, Korea

11:30 AM III-4: Novel Active Differential Phase Splitters in RFIC for Wireless Applications

H. Ma, S.J. Fang, F. Lin, Inst. of Microelectronics, Singapore; H. Nakamura, Oki Techno Centre, Singapore

11:50 AM III-5: A Low Distortion GaAs Quadrature Modulator IC

J. Itoh, T. Nakatsuka, T. Uda, T. Yokoyama, M. Maeda, O. Ishikawa, Elect. Research Lab., Matsushita Electronics Corp., Osaka, Japan; K. Sato, Comm. Systems Div., Matsushita Comm. Ind. Co.; Y. Imagawa, Matsushita Comm. Kanazawa R&D Labs.

Session IV Transmitter ICs - Room 343/344

Chair: M. Madihan, NEC C&C Research Lab

Co-chair: J. Moniz, IBM

10:30 AM IV-1: New Type of Class A/F Amplifier MMIC for Use in Commercial PCS Multiple Modulation Format Base Station Power Amplification

D. Helms, M. Mokalla, N. Vladimirovsky, M. Testa, D. Wells, Celwave, Corvallis, OR

- 10:50 AM **IV-2: 49% Efficiency Power Amplifier MMIC Utilizing SrTiO₃ Capacitors for 3.5V Li-Ion Battery Operated CDMA Cellular Phones**
N. Iwata, K. Yamaguchi, T.B. Nishimura, Kansai Elect. Research Labs., NEC Corp., Shiga, Japan; K. Takemura, Y. Miyasaka, Fund. Research Labs., NEC Corp.
- 11:40 AM **IV-3: IMD Elimination and ACPR Improvement for an 800 MHz HBT MMIC Power Amplifier**
F. Ali, M.R. Moazzam, Nokia Mobile Phones, San Diego, CA; C. Aitchison, Dept. of EE, Brunel Univ., UK
- 11:30 AM **IV-4: A 3.4V, 1 Watt Cellular DAMPS GaAs MESFET Power Amplifier with 50% Efficiency**
S.S. Taylor, TriQuint Semiconductor Inc., Hillsboro, OR
- 11:50 AM **IV-5: A Highly Integrated T/R Module for Active Phased Array Antennas**
K. Fujii, Y. Hara, Y. Shibuya, T. Sakai, Y. Takano, Japan Radio Co. Ltd., Tokyo, Japan

Session V Trends in Silicon and III-V Integration - Room 307/309

Invited Session

Chair: F. Ali, Nokia Mobile Phones

Co-chair: V. Nair, Motorola

- 1:30 PM **V-1: Integration Trends with RF Silicon Technologies in Mobile Radio Applications**
S. Atkinson, Analog Devices, Wilmington, MA
- V-2: Recent MMW Technology Development and Its Military and Commercial Applications**
K.-F. Lau, L. Liu, S. Dow, TRW S&EG, Redondo Beach, CA

Session VI Cordless Telephone ICs - Room 341/342

Chair: D. Lovelace, Motorola SPS

Co-chair: M. Calcaterra, USAF Wright

- 2:50 PM **VI-1: A 2.7V Image Reject Receiver for DECT**
A. Henke, K. Hadjizada, S. Heinen, G. Li Puma, W. Geppert, Siemens AG, Dusseldorf, Germany
- 3:10 PM **VI-2: A 900 MHz Image-reject Transceiver Si Bipolar IC**
P. Katzin, A.P. Brokaw, G. Dawe (currently with GHz Circuit Design), B. Gilbert, L. Lynn, J.M. Maurant (currently with IBM), Analog Devices, Wilmington, MA
- 3:30 PM **VI-3: A Single-chip 1.9 GHz RF Transceiver MMIC Using GaAs MESFET Technology**
H. Ma, R. Singh, K.T. Yan, S.J. Fang, F. Lin, K.S. Tan, Inst. of Microelectronics, Singapore
- 3:50 PM **VI-4: A Single Chip PHS Front-end MMIC with a True Signal +3V Voltage Supply**
Y. Kawaoka, T. Katamata, T. Tsutsumi, T. Yamamoto, T. Marukawa, F. Okui, S. Fukuda, RF Semicond. Prod. Dept., Murata Mfg. Co., Shiga, Japan, E. Grace, Murata Elect. North America, Smyrna, GA
- 4:10 PM **VI-5: Architectures of Highly Integrated RFICs for 900 MHz US Digital Cordless Systems**
N. Camilleri, Advanced Micro Systems, Sunnyvale, CA
- 4:30 PM **VI-6: A DECT RF Transmitter with Integrated VCOs Suitable for Open Loop GFSK Modulation**
O. Kromat, S. Heinen, U. Matter, G. Li Puma, M. Zannoth, Siemens AG, Dusseldorf, Germany

Session VII Design Techniques and Methodology - Room 339/340

Chair: L.C.T. Liu, TRW

Co-chair: L. Larson, UCSD

- 2:50 PM **VII-1: Interference Issues in Silicon RFIC Design**
Z. Zhang, A. Pun, J. Lau, Dept. of EE, The Hong Kong Univ. of Sci. and Technology, Hong Kong, P.R. China
- 3:10 PM **VII-2: Highly Accurate Spurious-free Integrated VCO Resonator in a GSM Transceiver Using Circuit-package Co-design**
J. Lin, R.H. Yan, R.C. Frye, P.R. Smith, Y.L. Low, Bell Labs, Lucent Technologies, Murray Hill, NJ
- 3:30 PM **VII-3: Plastic Microwave Multi-chip Modules for Wireless Communication Applications**
V. Krishnamurthy, E. Balch, K. Durocher, J. Rose, R. Saia, D. Lester, GE Corp. Research and Dev. Ctr., Schenectady, NY; D. Sherwood, Lockheed Sanders, Nashua, NH

- 3:50 PM **VII-4: Analysis and Performance of BGA Interconnects for RF Packaging**
D. Staiculescu, A. Pham, J. Laskar, Packaging Research Ctr., Georgia Inst. of Technology, Atlanta, GA; S. Consolazio, S. Moghe, Northrop Grumman Corp., Rolling Meadows, IL
- 4:10 PM **VII-5: VCO Linearisation by Frequency Feedback**
J. Gustrau, F. Fiechter, M. Hoffmann, Microwave Techniques, Ulm Univ., Ulm, Germany
- 4:30 PM **VII-6: On The Optimum Width of GaAs MESFETs for Low Noise Amplifiers**
S.S. Taylor, TriQuint Semiconductor Inc., Hillsboro, OR
- 4:50 PM **VII-7: Design of High Performance Gilbert-cell Mixers for GSM/DCS Front-ends**
S. Colomines, T. Arnaud, Motorola Semiconductors, Toulouse, France; R. Parra, J. Graffeuil, LAAS-CNRS and Univ. Paul Sabatier, Toulouse, France

Session VIII RFCMOS and Silicon ICs - Room 343/344

Chair: M.K. Ravel, Tektronix

Co-chair: N. Camilleri, AMD

- 2:50 PM **VIII-1: Silicon Monolithic Balanced Oscillators Using On-chip Suspended Active Resonators**
Y. Sun, Bell Labs Ulrecht, Lucent Technologies, Nieuwegein, The Netherlands; J.L. Tauritz, Delft Inst. of Technology, Delft, The Netherlands; R.G.F. Bates, Univ. of Gent, Gent, Belgium
- 3:10 PM **VIII-2: A Sub 1-V SOI CMOS Low Noise Amplifier for L-band Applications**
H. Komurasaki, H. Sato, N. Sasaki, K. Ueda, S. Maeda, Y. Yamaguchi, T. Miki, ULSI Lab., Mitsubishi Elect. Corp., Hyogo, Japan
- 3:30 PM **VIII-3: Micropower CMOS RF Components for Distributed Wireless Sensors**
T.-H. Lin, H. Sanchez, W.J. Kaiser, Elect. Engr. Dept., Univ. of California, Los Angeles, CA
- 3:50 PM **VIII-4: Silicon-on-sapphire MOSFET Distributed Amplifier with Coplanar Waveguide Matching**
P.F. Chen, R.A. Johnson, M. Wetzell, P.M. Asbeck, Univ. of California, San Diego, CA; P.R. de la Houssaye, G.A. Garcia, I. Lagnado, Space and Naval Warfare System Command (SPAWAR), San Diego, CA
- 4:10 PM **VIII-5: F-inductor and BC-MOS Technology for Monolithic Silicon RFICs**
J.-S. Kim, C.-H. Park, S.-H. Kim, G.-H. Ryu, K.-S. Soo, Sch. of Elect. Engr. and Inter-Univ. Res. Ctr. (ISRC), Seoul Nat. Univ., Seoul, Korea
- 4:30 PM **VIII-6: Improvement of the Quality Factor of RF Integrated Inductors by Layout Optimization**
J.M. Lopez-Villegas, J. Samitier, Dept. de Fisica Aplicada i Electronica, Univ. of Barcelona, Barcelona, Spain; C. Cane, P. Losantos, CNM, Campus UAB, Bellaterra, Spain
- 4:50 PM **VIII-7: Unaided 2.5 Gb/s Silicon Bipolar Clock and Data Recovery IC**
G. Gutierrez, S. Kong, AMCC, San Diego, CA

Tuesday, June 9, 1998

Session IX - mm-wave MMICs for Receiver Applications - Joint with IMS

10:10 AM-11:50 AM Refer to MTT-S Session TU2B-Room 309/310

Session X - Wireless ICs and Circuits - Joint with IMS

1:30 PM-2:50 PM Refer to MTT-S Session TU3B-Room 309/310

Session XI - Multi-function MMW ICs - Joint with IMS

3:20 PM-4:40 PM Refer to MTT-S Session TU4B-Room 309/310

Session XII - ISM/Cellular/PCS ICs - Joint with IMS

10:10 AM-11:50 AM Refer to MTT-S Session TU2D-Room 318/323

Session XIII - mm-wave MMIC Technology - Joint with IMS

1:20 PM-2:50 PM Refer to MTT-S Session TU3D-Room 318/323

Session XIV - Transceiver ICs - Joint with IMS

3:30 PM-5:10 PM Refer to MTT-S Session TU4D-Room 318/323

RFIC STEERING COMMITTEE

Vijay Nair, General Chair, Motorola Corp. Research Labs
Christian Kermarrec, TPC Chair, Analog Devices Inc.
Fazal Ali, Finance, Nokia Mobile Phones
Sayfe Kiaei, Transactions, Motorola Inc.-SPS
Jim Moniz, Publicity, IBM
Jyoti Mondal, Digest, Northrop Grumman
Dave Lovelace, Secretary, Motorola Inc.-SPS

RFIC TECHNICAL PROGRAM COMMITTEE

Aharon Adar, Anadigics
Stefan Heinen, Siemens AG
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Mohammad Madihian, NEC C&C Research Labs
Eliot Cohen, Palisades Institute for Research Services Inc.
Natalino Camilleri, AMD
Ho C. Huang, Comtech Communications Inc.

Louis Liu, TRW Inc.
Inder Bahl, ITT GaAs Technology Center
Eric Strid, Cascade Microtech Inc.
Linda Katehi, University of Michigan
Mihir Ravel, Tektronix Inc.
Mark Calcaterra, USAF Wright Laboratory
Tsuneo Tokumitsu, NTT Radio Wireless Systems Labs
Mahesh Kumar, Lockheed Martin
Reynold Kagiwada, TRW Inc.

WSA: WIRELESS LOCAL LOOP (WLL) SYSTEMS: TECHNOLOGIES, OPPORTUNITIES AND MARKET

Format: Tutorial and Advanced Topic with Working Forum (Panel Discussion)

Date & Time: June 7, 1998; 8:00 AM–5:00 PM

Topics and Presenters:

- *Overview of Wireless Technology & Business Opportunity*, **Marty Cooper**, Arraycomm
- *Wireless Evolution in Local Loop and Future Systems*, **Howard Sherry**, Wireless System Research, Bellcore
- *Worldwide Demand for Wireless Local Loop Systems*, **Herschel Shostek**, Herschel Shostek Assoc.
- *IS-95-based WLL Technology and Economic Considerations*, **Joe DeCamp**, Motorola-Cellular Infrastructure Group
- *Business and Regulation Affecting WLL Deployment*, **David Aylward**, National Strategies
- *Smart Antenna Technology in WLL Communication Systems and Applications*, **Richard Roy**, Arraycomm
- *CDMA Technology and Economics for WLL Systems*, **Anil Kripalani**, QUALCOMM
- *Critical Path Toward Third Generation Wideband CDMA*, **Yiuman S. Leung**, Nortel

Organizer: Guo-Chun Liang, Conductus Inc.

Sponsors: MTT-16, Microwave Systems
MTT-19, Microwave Technology Business Issues
MTT-20, Wireless Communications

Abstract:

The demands of wireless local loop (WLL) service in developing and developed countries are immense. WLL technology is now becoming a cost-effective solution for local telephone network access. A variety of factors — technical advances, economic and social pressures to expand telecommunications services, and deregulation — have combined to create a bright future for fixed wireless solutions. The potential market is vast, especially in industrializing nations where the demand for high quality, rapidly deployable telecom service is the most acute. WLL technology generically offers a number of key advantages: faster deployment; early revenue realization; quick return on investment; low construction costs; low network maintenance, management and operating costs; and flexibility to meet uncertain levels of penetration and growth rates.

During this workshop invited experts will discuss the latest developments in WLL technologies and systems, deployment and future trends. They will present and review different technologies for the WLL systems and applications and different air interfaces for urban and rural environments. The workshop will provide up-to-date information on technologies, systems, regulations and spectrum allocations for the domestic and international markets. Case studies on WLL deployment will be presented.

WSB: LOW COST SI-BASED TECHNOLOGY FOR WIRELESS APPLICATIONS

Format: Tutorial

Date & Time: June 7, 1998; 8:00 AM–5:00 PM

Topics and Presenters:

- *RF Technology in Japan*, **Sanshiro Fukada**, Alliance plus ONE Inc., Japan
- *CMOS Circuit Application*, **Thomas Lee**, Stanford University
- *CMOS RFIC Technology*, **Akira Matsuzawa**, Matsushita Electric, Japan
- *BiCMOS RFIC Technology*, **Vance Archer**, Lucent Technology
- *RF-GCMOS Technology*, **David Ngo**, Motorola Inc.

- *UTSi RF Technology*, **Mohamed Megahed**, Peregrine Semiconductor
- *Si/SiGe Technology*, **Bernard Meyerson**, IBM
- *Si Bipolar Technology*, **Michael Wyatt**, Honeywell Inc.
- *Impact of CDMA Specifications on Circuit Design*, **Joe Tauritz**, Delft University, Netherlands

Organizers: Vijay Nair, Motorola Inc.
Mohamed Megahed, Peregrine Semiconductor

Sponsors: MTT-6, Microwave and Millimeter-wave ICs
RFIC Symposium

Abstract:

New consumer-driven markets, driven by the desire to achieve higher levels of integration, smaller chip size and lower power consumption, are spurring the interest in low cost Si-based technology. CMOS, BiCMOS, Si Bipolar and SOI technologies are gaining ground against compound semiconductor technology in the commercial wireless market due to their lower cost. This workshop will discuss the latest developments in Si-based technology as applied to RF wireless systems. Process improvements that would lead to higher levels of integration also will be discussed. Circuit design and layout consideration, as well as packaging issues that affect system performance will be presented. Future trends including a possible one-chip solution for RF wireless applications also will be addressed. A review of different technologies such as CMOS, BiCMOS, Si/SiGe, RF-GCMOS and UTSi will be followed by a discussion of RFIC circuit implementations of these technologies.

WSC: COMPARISON OF THE VARIOUS MCM TECHNOLOGIES FOR MICROWAVE MULTICHIP ASSEMBLIES

Format: Tutorial with Working Forum

Date & Time: June 7, 1998; 8:00 AM–5:00 PM

Presenters:

- **Bill Minehan**, Coors Electronic Packaging Company
- **Steven Consolazio**, Northrup-Grumman
- **Jean-Pierre Lanteri**, M/A-COM
- **Andrew Shapiro**, Hughes Aircraft Company
- **Aicha Elshabini-Riad**, Virginia Polytechnic Institute
- **Steven Annas**, Vispro Corporation
- **Chet Giles**, Arlon Materials Division
- **Paul Cooper**, Sanders Corporation
- **Joy Laskar**, Georgia Tech

Organizers: Rick Sturdivant, Hughes Aircraft Co.
Joy Laskar, Georgia Tech

Sponsor: MTT-12, Microwave
and Millimeter-wave Packaging

Abstract:

Microwave multichip assembly (MMCA) technology has made significant advances over the last decade. These modules are characterized by one or more microwave devices, which are often MMICs, passive components such as capacitors and resistors, silicon control circuits and a substrate that is usually multilayer. This workshop will concentrate on the substrate portion of the module. Specifically, the competing substrate technologies will be compared for electrical and thermal performance, interconnect density, cost, manufacturing variability and reliability. The benefits and drawbacks of each technology will be reviewed and compared for various applications, including commercial communication products such as PCS and cellular, satellite products and military products such as T/R modules. The major multichip module approaches including MCM-C (ceramics), MCM-D (deposited) and MCM-L (laminated) will be included as well as some mixed-technology techniques. The session will conclude with a matrix of available substrate technologies summarizing the ability of each approach to meet specific microwave packaging technology needs.

WMA: COMPUTER-AIDED DESIGN, ELECTROMAGNETIC MODELING AND MEASUREMENT FOR ELECTRONICS PACKAGING AND INTERCONNECTS

Format: Tutorial

Date & Time: June 8, 1998; 8:00 AM–5:00 PM

Topics and Presenters:

Packaging Strategies

- *MCMs, 3D Packaging, Wafer Scale Packaging, Plastic Packaging*, **R. Sturdivant**, Hughes Aircraft Company
- *Flip-chip Modules and Interconnections*, **W. Heinrich**, FBH

Packaging Models

- *Full-scale Simulation of Packages*, **A. Cangellaris**, University of Illinois; **N. Burls**, Motorola
- *Radiative Coupling and Equivalent Sources*, **R.W. Jackson**, University of Massachusetts
- *Ground Bounce*, **J. Prince**, University of Arizona

Measurement Techniques

- *Transmission Line Physics and Characterization*, **D. Williams**, NIST
- *Multi-port Measurements*, **L. Martins, S. Sercu**, University of Gent
- *Peeling and Model Development from Time-domain Measurements*, **V. Tripathi**, Oregon State University

Application of Commercial Simulation Tools

- *Discrete Component Simulators*, **P. O'Halloran**, Hewlett Packard
- *2.5D Simulators*, **J. Rautio**, Sonnet Software
- *3D Simulators*, **Z. Cendes**, Ansoft

Organizers: Dylan Williams, NIST
Vijay Tripathi, Oregon State University
Wolfgang Heinrich, FBH

Sponsors: MTT-12, Microwave and Millimeter-wave Packaging
MTT-1, Computer-aided Design

Abstract:

This tutorial workshop will present a review of the most widely used numerical methods, measurement methods and models for electronics packaging. It will treat the JEDEC packaging standard, direct measurement methods, packing algorithms, packaging models and common numerical simulation tools. The workshop will feature 45-minute breaks with demonstrations to encourage interaction between participants and instructors.

WMB: MICROWAVE/LIGHTWAVE METHODS FOR INDOOR AND OUTDOOR WIRELESS AND MOBILE COMMUNICATION

Format: Tutorial with Working Forum

Date & Time: June 8, 1998; 8:00 AM–5:00 PM

Topics and Presenters:

- *Opening Remarks*, **T. Berceli**, Technical University of Budapest, Hungary
- *Introduction and Overview*, **T. Berceli**
- *Wireless Services, Systems and Network Configurations, Digital Modulation Methods, Shadowed and Indoor Areas Issues, Millimeter Waves*, **L. Drabeck**, Lucent Technologies, USA
- *Optical Methods: Introduction, Digital Techniques, Analog Techniques, System Overview*, **M. Gans**, Lucent Technologies, USA
- *Broadband Optical-wireless Systems*, **R. Heidemann**, Alcatel, Germany
- *Optical Fiber Transmission of Cellular and PCS Signals*, **P.R. Herczfeld**, Drexel University, USA
- *Analog Optical Systems Analysis*, **J. Georges**, LGC Corp., USA
- *Wireless CDMA Transmission in HFC Systems*, **W. Way**, National Chiao-Tung University, Taiwan

- *Optical Components and Related Issues*, **M. Wale** and **C. Edge**, GEC-Marconi, UK
- *Panel Discussion and Questions*, **R. Heidemann**
- *Optical Fiber Transmission of LMDS, MMDS, DBS Signals and Technology Challenges*, **W. Way**
- *Millimeter Wave LMDS Transmission Via Optical Fibers*, **K.Y. Lau**, University of California Berkeley, USA
- *Novel Photonic Techniques for Signal Upconversion, Downconversion and Multiplication in mm-wave Systems*, **S. Yao**, Jet Propulsion Labs, USA
- *MMDS/LMDS Signal Transmission via Optical Fibers and Related Topics*, **A. Elrefaie**, Hewlett Packard Co., USA
- *Advanced Optical Components, External Modulation Methods for Millimeter Waves*, **D. Novak**, University of Melbourne, Australia
- *Software Radio Networks Using Virtual Radio Free Space*, **S. Komaki**, Osaka University, Japan
- *Advanced Optical Fiber Transmission Technologies for Wireless Applications*, **J. Plourde**, Lucent Technologies, USA
- *A Millimeter Wave Fiber Radio Utilizing a Microchip Laser*, **P.R. Herczfeld** and **T. Berceli**
- *Novel Components, Systems and Architectures for Fiber Delivery of mm-wave Wireless Signals*, **D. Novak**
- *Fiber Radio Systems Applications*, **H. Burkhard**, Deutsche Telecom, Germany
- *Panel Discussion and Questions*, **P.R. Herczfeld**
- *Closing Remarks*, **P.R. Herczfeld**

Organizers: Tibor Berceli
Peter Herczfeld
James Plourde
Winston Way

Sponsor: MTT-3, Lightwave Technology

Abstract:

This full-day workshop will cover both analog and digital fiber-optic methods for outdoor and indoor wireless and mobile communications as well as optical fiber transmission methods of LMDS, MMDS and DBS signals. The workshop will provide tutorial information to give participants an understanding of the fundamentals, as well as information on state-of-the-art systems and advanced R&D issues. The workshop is a starting point for design or subsystems applications work and a foundation for the continued self study of advanced topics. The format will encourage audience participation by allowing ample time for questions and interactions throughout each presentation. The topics discussed in this workshop are of high interest to the MTT community at this time because wireless systems and services are forecast to continue their explosive growth into the next decade. The merits of various standards such as GSM, IS-95, IS-136 and PDC, and data structures such as CDMA vs. FDMA/TDMA are under intense debate. With the worldwide deregulation of communications, cable TV, local telephone, long distance telephone, cellular, paging and direct broadcast, satellite service providers are competing to provide video, voice, data, Internet access and paging services. Many system configurations are being proposed or are under development. In addition, the issue remains as to how to provide wireless coverage to shadowed or indoor areas where RF signals do not propagate. Solutions range from passive reflectors and RF repeaters to microcells and picocells. Optical fiber approaches offer economical and attractive networking technology.

WMC: LOW COST DIGITAL AND ANALOG OPTOELECTRONIC MODULES: MANUFACTURING AND SYSTEMS INSERTION

Format: Tutorial plus Working Forum

Date & Time: June 8, 1998; 8:00 AM–5:00 PM

Topics and Presenters:

- *Light Modulators for Microwave Photonics*, **M. Izutsu**, Communications Research Laboratory, Ministry of Posts and Telecommunications, Japan
- *Rugged, High Performance Microwave Link Subsystems for Airborne Towed Radar Decoys*, **N. Try, C. Edge, J. Burgess, A. Carter, M. Wale**, GEC-Marconi
- *Recent Advances in Electroabsorption Waveguide Modulators for RF Links*, **Y.Z. Liu**, Fermionics Lasertech
- *Approaches and Issues of Optical ADC*, **C. Cox**, Lincoln Lab
- *WEST Program 10 Gbit/s Fiber-optic Link*, **M. Swass**, Ortel
- *Low Jitter and High Frequency Optoelectronic Clocks/Oscillators*, **S. Yao**, Jet Propulsion Lab
- *Optoelectronic Components for 10 Gbit/s Telecommunications Systems*, **M. Kimber**, Nortel Optoelectronics
- *Low-cost Packaging for RF Optoelectronic Modules*, **R. Marsland**, New Focus
- *Rugged and Multifunction Packaging of Optoelectronic Components*, **F. Deborgies**, Thomson-CSF
- *IC Technologies for Improving Optical Access System Performances*, **K. Emura**, C&C Media research Laboratories, NEC, Japan
- *Practical Methods to Reduce Cost and Complexity of Optically Controlled Phased Arrays*, **J. Wang**, Wang Electro-optic Corp.
- *Microwave Fiber-optic Links for Military Applications*, **S. Pappert**, SPAWAR
- *Photonics Technology for CATV Applications*, **J. Kenny**, Antec
- *Fiber Optics for Satellite Communication*, **T. Karras, A. Paoletta**, Communications and Power Center, Lockheed Martin

Organizers: P. Yu, UC San Diego
S. Daryoush, Drexel University, Philadelphia
M. Wale
S. Chandrasekhar, Bell Laboratories,
Lucent Technologies

Sponsors: MTT-3, Lightwave Technology
MTT-6, Microwave
and Millimeter-wave Integrated Circuits
MTT-18, Microwave Superconductivity

Abstract:

This full-day working forum workshop will focus on design, realization and system insertion of high performance optoelectronic circuits and modules in a variety of analog and digital systems. Insertion into the fiber channel and sub-carrier analog fiber-optic links will be emphasized. The discussion will range from component selection and integration with high-speed electronics, low cost packaging and digital/analog conversions, and various fiber-optic link applications. Technologists from industry, government labs and academia will present state-of-the-art techniques in developing and applying high-speed optoelectronic modules. The workshop begin with advances in OE transceivers and circuits, followed by presentations on packaging and system insertion. Each section will conclude with a discussion period; audience participation is encouraged.

WMD: ADVANCES IN AMPLIFIER LINEARIZATION

Format: Tutorial plus Working Forum

Date & Time: June 8, 1998; 8:00 AM-5:00 PM

Topics and Presenters:

- *Linearizer Basics*, **A. Katz**, The College of New Jersey
- *MMIC Linearizers*, **R. Dorval**, Lockheed Martin Missiles and Space
- *Linearization of HBT and FET Amplifiers*, **K. Kobayashi**, TRW Systems and Electronics Group
- *Linearizers in Space*, **S. Moorchalla**, Lockheed Martin Missiles and Space

- *Linearizers for LMDS and Millimeter Applications*, **J. Dragone**, Linearizer Technology Inc.
- *Linearization for Cellular Base Stations*, **G. Hau**, University of Leeds
- *Cartesian Feedback Linearization*, **H. Kim**, Bell Labs
- *Baseband and Adaptive Linearization Techniques*, **P.B. Kenington**, Wireless Systems International Ltd.
- *A Kahn Technique Transmitter*, **Bernie Sigmon**, Motorola

Organizers: Jitendra Goel, TRW Systems and Electronics Group
Allen Katz

Sponsors: MTT-5, Microwave High-power Techniques
MTT-16, Microwave Systems
MTT-20, Wireless Communications

Abstract:

New communications services and technologies have created a demand for highly linear power amplifiers. Cellular telephony, digital television and high speed data communications are examples of applications that require highly linear amplifiers. High amplifier linearity normally requires a large sacrifice in amplifier power capacity and efficiency. This workshop will review the state-of-the-art in linearization. Linearization increases an amplifier's linearity without greatly degrading its power capacity or efficiency. Techniques such as feedforward, feedback and predistortion will be discussed and their merits compared. In addition, methods for the evaluation of linearity and their significance will be introduced. The latest developments in linearizer technology, including adaptive digital techniques, also will be covered. Finally, applications spanning the spectrum from RF to millimeter wave will be presented.

WME: MULTILAYER MICROWAVE CIRCUITS

Format: Tutorial

Date & Time: June 8, 1998; 8:00 AM-5:00 PM

Topics and Presenters:

- *Isolation Characteristics of Via Structures in High Density Microwave Stripline Packages*, **J. Gippich**, Northrop Grumman, USA
- *Design of Multilayer Filters and Baluns*, **K.C. Gupta**, University of Colorado at Boulder, USA
- *CAD for MICs/MMICs Including Multilayer Structures and MCM Technology*, **R.H. Jansen** et al., RWTH Aachen University of Technology, Germany
- *Low Loss High Performance Multilayer Passive Components for MMICs*, **I. Bahl**, ITT GaAs Technology Center, USA
- *Integrated Multilayer RF Passives in Silicon Technology*, **J.N. Burghartz**, IBM T.J. Watson Research Center, USA
- *Embedded Transmission Line (ETL) MMICs for Applications in Multilayer Microwave Circuits*, **H.Q. Tserng**, Texas Instruments, USA
- *Three-dimensional MMIC Technology and Its Application to Advanced MMIC Design Method*, **I. Toyoda**, NTT Laboratories, Japan
- *RF Diode Switches Using Ceramic Multilayer Substrate*, **H. Mandai, T. Turu, N. Nakajima**, Murata Manufacturing Co., Japan
- *The Evolution of High Packing Density MMICs Using a Multilayer Technology*, **F. Myers**, GEC-Marconi Materials Technology, Caswell, UK
- *The Design of RF Functions in MCM-D Technology*, **R.G. Arnold, D.J. Pedder**, GEC Plessey Semiconductors, UK

Organizers: K.C. Gupta
Rolf H. Jansen

Sponsor: MTT-1, Computer-aided Design

Abstract:

Multilayer configurations provide another dimension in the integration and compaction of RF and microwave components, circuits and systems. Another strong reason for employing multilayer configurations is that several circuit functions (such as baluns, couplers, etc.) that are difficult to realize in single-layer planar configuration can be obtained conveniently in two- or multiple-layer configurations. Multilayer configurations also provide a convenient method for integrating circuits and printed antennas in single modules. Following the great success of a similar workshop during IMS '96, the purpose of this workshop is to present the state of the art in the design and technology of multilayer microwave modules. Emphasis is placed on design aspects. Participants are encouraged to bring one or two viewgraphs for expressing their viewpoints.

WMF: ACCURATE DIELECTRIC CHARACTERIZATION OF PWB SUBSTRATES

Format: Tutorial

Date & Time: June 8, 1998; 8:00 AM–12:00 PM

Topics and Presenters:

- *Introduction and Overview*, **Claude M. Weil**, NIST
- *Industry Needs*, **V. Krishnamurthy**, GE Corp. R&D
- *Stripline Resonator Methods*, **G. Robert Traut**, Rogers Corp.
- *Evanescence Mode Cavity*, **G. Kent**, GDK Products
- *Open Structure Resonator*, **W.R. Humbert**, AF Research Lab
- *Full Sheet Resonance Method*, **B. Riddle**, NIST

Organizer: Claude M. Weil

Sponsor: MTT-11, Microwave Measurements

Abstract:

The increasing use of computer-based software packages for designing RF/microwave components, circuits and systems requires that very accurate data be available on the dielectric properties (such as complex permittivity) of the printed wiring boards (PWB) or substrates to be used in the design. Often, these data are not known to have the accuracy required by users. This workshop will review and compare many of the basic measurement techniques for characterizing the polymer and ceramic materials generally used in PWBs, including the stripline resonator, re-entrant cavity, split-post resonator, radial-mode resonator, full-sheet resonance and "Kent" dielectrometer methods. Many of the improvements that have recently been realized in measurement methods, which have resulted in significant reductions in measurement uncertainties, will be emphasized. The important issues of whether PWB materials exhibit anisotropic properties or not and how to measure them will also be addressed.

WMG: CRYOGENICS: A NEW BEGINNING

Format: Tutorial with Working Forum

Date & Time: June 8, 1998; 8:00 AM–12:00 PM

Topics and Presenters:

- *Measurement of Signal and Noise Parameters at Cryogenic Temperatures in the 1–100 GHz Frequency Range*, **M. Pospieszalski**, NRAO
- *Cryogenic Requirements for Wireless Applications*, **G. Koepf**, Superconducting Core Technologies
- *Overview of Cryogenic Refrigerators*, **P. Kerney**, Conductus Inc.
- *Setting Up and Calibration of a Cryogenic Test Station*, **J. Pond**, Naval Research Lab.
- *Subtle Contributions to Noise Output Due to Quantum Effects*, **A. Kerr**, NRAO

Organizer: James Whelehan, AIL Systems Inc.

Sponsors: MTT-14, Microwave Low Noise
MTT-18, Microwave Superconductivity

Abstract:

Whenever the ultimate in performance is required for a microwave system, operation at physical temperatures below room temper-

ature has been used. In the past, parametric amplifiers and masers cooled to temperatures approaching absolute zero were used in microwave systems to achieve the desired system low noise performance. However, recent developments with III-V HEMT amplifiers with impressive low noise performance basically halted future developments of cooled receivers. Present applications for cryogenic cooling are the front ends of receivers for radioastronomy needs where superconducting SIS mixers and/or HEMT amplifiers are still used. However, with the near exponential increase in personal communications usage, interest in cryogenic operation of microwave components has again emerged. The use of high temperature superconducting band-pass filters and low noise HEMT amplifiers, both of which are cooled to liquid nitrogen temperatures (77 Kelvin), is being evaluated to extend the operating range of wireless base stations as well as provide enhanced out-of-band rejection from adjacent bands. The use of superconducting and cryogenic components to enhance the performance and throughput of wireless communication satellite systems is also being seriously considered. The design, fabrication and testing of these cryogenically cooled components and subsystems require accurate measurements of the microwave characteristics of these components while they are at cryogenic temperatures. However, a problem is that microwave test equipment is operated at room temperature. This workshop will focus on the issues associated with very precise measurements of insertion loss, noise figure and gain to realize absolute accuracy of 0.1 dB. This workshop will address these issues and solicit comments and suggestions from the audience to encourage an active exchange of ideas and to initiate formulations of appropriate measurement techniques and procedures.

WMH: INTEGRATION OF FERRITE DEVICES INTO FUTURE RADAR, WIRELESS AND SPACE SYSTEMS

Format: Tutorial plus Working Forum

Date & Time: June 8, 1998; 8:00 AM–12:00 PM

Topics and Presenters:

- *Lumped Element Circulator for Mobile Telephones*, **T. Muira**, TDK
- *Monolithically Integrated Ferrite Device Technology*, **S.W. McKnight**, Northeastern University
- *Wireless Antennas*, **El-Badawy El-Sharawy**, Arizona State University
- *System Requirements Flow Down to Ferrite Requirements*, **S. Borden**, Northrop Grumman
- *Ferrite Components for Phased Arrays*, **W. Williams**, EMS Inc.
- *High Performance Ferrite Components for Radar and Communication Systems*, **W. Hord**, Microwave Applications Group

Sponsor: MTT-13, Ferrite Components

Organizers: L.E. Davis, UMIST, UK
El-Badawy El-Sharawy

Sponsor: MTT-13, Ferrite Components

Abstract:

Progress is being made in CAD for ferrite components as demonstrated during the IMS workshops and symposia in 1996 and 1997. The major challenges facing the systems community are how to retain the benefits of ferrite devices along with systems integration in a cost-effective manner in radar, wireless and space systems. Low cost and small size are key requirements for commercial systems, such as those for wireless and vehicular markets, and, consequently, trade-offs with performance can be negotiated. On the other hand, space and high-end radar systems (military and civil) must still focus on performance with less emphasis on cost. Thus, these two sectors have equally challenging, but different, engineering philosophies. Speakers with systems, as well as ferrite, experience have been drawn from these two sectors, and present and future challenges will be addressed. A substantial period for discussion will be included and informal five-minute presentations (with view-foils) from the attendees will be encouraged.

WMI: ANALOG TO DIGITAL CONVERTERS FOR DIGITAL RECEIVER SYSTEMS

Format: Advanced Topics and Tutorials

Date & Time: June 8, 1998; 1:00–5:00 PM

Topics and Presenters:

- *Digital Receiver: Technologies and Requirements*, **J. Tsui**, Wright Labs, Dayton, OH
- *Receivers for Wideband Communication*, **B. Cultrera**, Lockheed Sanders, CT
- *Design and Performances of Rockwell's Multi-GHz 8-10 Bit ADC Using GaAs HBT Technology*, **Ruai Yu**, Rockwell International, Thousand Oaks, CA
- *A 3 GHz 8-bit ADC Module for Digital Receivers*, **Bert Oyama**, TRW, Rodondo Beach, CA
- *High Precision Pipeline ADC for Communication Systems*, **Paul Yu**, DSP R&D Center, Texas Instruments, Dallas, TX
- *Oversampling ADC for Cellular Receivers*, **Tom Gratzek**, Analog Devices, Greensboro, NC
- *Resonant-tunneling Multiple-valued Quantizer for Ultrahigh-speed A/D Converter*, **Toshihiro Itoh**, NTT System Electronics Labs, Atsugi, Kanagawa, Japan

Organizers: Christopher Chang, Raytheon TI Systems
Klaus Breuer, Tracor Aerospace

Sponsors: MTT-9, Digital Signal Processing
MTT-16, Microwave Systems

Abstract:

Digital receivers, through the conversion of analog signals to digital data, can provide substantial cost and/or performance improvements to modern electronic systems. This workshop describes different applications and the associated requirements for different digital receivers. To meet these requirements, analog-to-digital converters (ADC) with different architectural organizations and device technologies are discussed. Among these are two >8 bit, 2–4 GHz GaAs ADC systems for wideband applications. Two silicon CMOS ADCs with different chip organizations are also discussed. Using a self-calibrating scheme, the pipeline ADCs can achieve up to 16-bit resolution with relatively minor increase in power dissipation. An additional method employing oversampling techniques to achieve high bit resolution for wireless communication is also presented. A quaternary quantizer using a resonant-tunneling device points to a possible future direction ADC development. This workshop features experts from leading R&D and manufacturing organizations who discuss ADC implementations for different receiver requirements. While the talks cover many advanced materials, background materials will be included for tutorial purpose. The settings are more informal than the technical sessions in that they offer ample opportunity for discussions.

WMJ: TECHNOLOGIES FOR TUNABLE MICROWAVE SYSTEMS

Format: Tutorial plus Working Forum

Date & Time: June 8, 1998; 1:00–5:00 PM

Topics and Presenters:

- *The DARPA 'Frequency Agile Materials for Electronics' Program*, **Stuart Wolf**, DARPA
- *Semiconductor Devices*, **Peter Staecker**, M/A-COM Inc.
- *Low Cost Phased Arrays*, **Dharmesh Patel**, Naval Research Lab.
- *Ferroelectric Microwave Devices for Wireless Communication Systems*, **Spartak Gevorgian**, Chalmers Univ. and Ericsson
- *Ferroelectric Varactors for VCOs*, **Steve Kirchoefer**, Naval Research Lab.
- *Magnetically Tunable Devices*, **Dan Oates**, MIT Lincoln Labs
- *Use of MEMS as Tunable Elements in Microwave Circuits*, **K.C. Gupta**, University of Colorado

Organizers: Jeffrey Pond, Naval Research Lab
Charles Jackson, TRW

Sponsor: MTT-18, Microwave Superconductivity

Abstract:

This workshop will focus on examining the advantages to microwave systems of various tuning technologies. Low loss and low cost technologies are of critical need for wireless systems as well as phased array antennas. The last several years have seen significant progress in both ferrite and semiconductor technologies for tunable systems. Other technologies such as MEMS (micro-electro-mechanical systems) and ferroelectrics are being investigated as alternatives to these conventional approaches. Each tunable microwave system has its unique requirements such as percent tunability, tuning speed, quality factor, size, weight, cost, etc., which can vary over orders of magnitude. Consequently, it is to be expected that there will not be any one tuning technology which will provide an optimum solution to every system need. The current emphasis on the commercial market is expected to place particular emphasis on the cost of these competing technologies. The expected rapid growth in the use of tunable microwave systems along with the expanding choices in tunable technologies provides a sound basis for the timeliness of this workshop. This workshop will address the range of needs of various tunable systems, from applications such as phase shifters in phased arrays to tuning a filter zero to eliminate co-site interference in wireless applications. Emphasis will be placed on defining present and anticipated system needs as well as perceived limitations imposed by the tuning technologies available. Presentations will also be made on different tuning technologies with emphasis on present and expected performance issues which are critical to system designers. This workshop is intended to provide a tutorial on the inherent advantages and limitations of various tunable technologies as well as educate the device designer on tunable system requirements. Interactions between the device and system community will be encouraged so as to focus development of these technologies to meet system needs.

WMK: IMT-2000: WHAT IS IT AND WHAT IS IN IT FOR THE MICROWAVE COMMUNITY?

Format: Tutorial plus Working Forum

Date & Time: June 8, 1998; 1:00–5:00 PM

Topics and Presenters:

- *IMT-2000 Background and Outlook: The MTT-S Perspective*, **F. Ivanek**, Communications Research
- *Framework for the Evaluation of Candidate Radio Transmission Technologies for IMT-2000*, **R.B. Engelman**, Planning and Negotiations Division, FCC/International Bureau
- *The Prospective Use of Software Defined Radio in IMT-2000 Radio Transmission Technologies*, **J.A. Hoffmeyer**, BellSouth Cellular Corp.
- *The Impact of IMT-2000 Developments on the Microwave Community*, **E. James Crescenzi, Jr.**, Spectrian Corp.

Organizers: E. James Crescenzi, Jr.
Ferdo Ivanek

Sponsor: MTT-20, Wireless Communications

Abstract:

International Mobile Telecommunications-2000 (IMT-2000) is the ITU standardization framework for third-generation mobile systems, which are expected to begin service in the year 2000. The goal of these systems is to provide global coverage with terminals capable of seamless roaming between multiple networks. The next phase of this ITU effort is an evaluation of candidate radio transmission technologies. The request for proposals was issued in April 1997 and the evaluation process is scheduled for the September 1997 through September 1998 period. The IMT-2000 goals are of great commercial interest, as is evident by the numerous commercial alliances and joint technical efforts reported by the press. The workshop will focus on these competitive developments, which are of vital interest to radio component and subsystem designers and manufacturers.

MONDAY PANEL SESSION

PMON1: LEVELS OF INTEGRATION FOR RFICs? THE ONE-CHIP RADIO: REALISTIC GOAL OR UTTER NONSENSE?

Date: Monday, June 8, 1998
Time: 12:00–1:15 PM
Location: Baltimore Convention Center, Room 318/323
Sponsor: 1998 RFIC Symposium-TPC
Organizers: Fazal Ali, Nokia Mobile Phones
Mike Golio, Rockwell Collins Commercial Avionics
Moderators: Fazal Ali
Mike Golio
Panelists: Speakers from industry

Although very high levels of RFIC integration (even one-chip radios) have been demonstrated, practical limitations such as cost, schedule, performance and risk almost always dictate a much lower level of integration.

Cost: Although the digital world has been able to continually increase levels of integration to advantage, larger RF chips create yield, cross-talk, packaging and test problems that are far more difficult to address than their analogous digital problems. Increased integration can often lead to increased cost.

Schedule: Time-to-market pressures often force RFIC wireless designers to seek solutions that offer quick product introductions as opposed to optimum performance.

Performance: Radio architectures often dictate the use of high Q filters and frequency selectivity, which cannot be realized on chip. Other specification pressures lead to the need for different semiconductor device technologies for different radio functions.

Risk: Risk is closely related to schedule. More risk often translates into more or longer design cycles, which can almost never be tolerated in the wireless world.

Each of these issues takes on different weights, depending on the application. In addition to integration levels of specific chips and the issues that contribute to level-of-integration decisions, future trends, emerging tools and technologies that may contribute to the development of higher levels of integration will be discussed.

TUESDAY PANEL SESSIONS

PTUE2: KEY POLICY ISSUES IN MICROWAVE SPECTRUM MANAGEMENT

Date: Tuesday, June 9, 1998
Time: 12:00–1:15 PM
Location: Baltimore Convention Center, Room 339/342
Sponsor: 1998 IMS TPC
Organizer: Michael Marcus,
Federal Communications Commission (FCC)
Moderator: Michael Marcus
Panelists: Richard Smith, FCC
Dale Hatfield, FCC
Additional speaker(s)

Domestic and international spectrum management issues can have a major impact on the development and application of new microwave technologies. Due to the proximity of Baltimore to Washington, there is unique opportunity for key FCC policymakers to meet IMS attendees to review current issues and explain the opportunities the microwave community has to make its voice heard in policy circles that deal with the technologies.

PTUE3: RESEARCH DIRECTIONS IN MICROWAVE CAD

Date: Tuesday, June 9, 1998
Time: 12:00–1:15 PM
Location: Baltimore Convention Center, Room 324/326
Sponsor: MTT-1, Computer-aided Design
Organizer: Michal Odyniec, Hewlett-Packard Co.
Moderator: Michal Odyniec
Panelists: John Bandler, McMaster University, Canada
Thomas Brazil, UCD, Ireland
Bruce Donecker, HP, USA
K.C. Gupta, UCD, USA
Anthony Pavio, Motorola, USA
James Rautio, Sonnet, USA
Ingo Wolff, Duisburg University, Germany

The goals of this panel session are to take a fresh look at research goals in microwave simulation and modeling, review the present state of research and discuss the directions that offer most promise. All the players (academia, national laboratories and industry) are interested in advancing the technology. However, industry focuses on low-risk, short-term goals; academia and laboratories focus on the long-term fundamental results. The areas in which these three players have similar goals and where their cooperation may be the most fruitful will be investigated. The session will comprise short (five- to eight-minute) presentations by the panelists, followed by the general discussion. Contributions from the audience are strongly encouraged.

MONDAY

TUESDAY

ALSO OCCURRING

Tuesday 8:00–10:00 AM

Plenary Session

Speakers: Benjamin Pontano,
COMSAT Laboratories
Arye Rosen,
Sarnoff Corp./
Drexel University
Arnold J. Greenspon,
Thomas Jefferson
Medical College

**Baltimore Convention Center
Ballroom**

TUESDAY, JUNE 9, 1998

IEEE MTT-S IMS TECHNICAL SESSIONS

TU2A Modeling and Optimization for CAD

Chair: K.C. Gupta, University of Colorado
Co-chair: Mauro Mongiardo,
University of Perugia
ROOM 307/308

10:10 AM

TU2A-1: Development of Knowledge Based Artificial Neural Network Models for Microwave Components
P.M. Watson, WL/AADI Avionics Directorate,
Wright-Patterson Air Force Base, OH; K.C. Gupta,
R.L. Mahajan, CAMPmode, Univ. of Colorado,
Boulder, CO,

10:30 AM

TU2A-2: A Neural Network Model for CAD and Optimization of Microwave Filters
P. Burrascano, M. Dionigi, C. Fancelli, M. Mongiardo,
Inst. di Elettronica, Univ. of Perugia, Perugia, Italy

10:40 AM

TU2A-3: Unrestricted Arbitrary Shape Optimization Based on 3D Electromagnetic Simulation
A. Kozak, W. Gwarek, Inst. of Radioelectronics, Warsaw
Univ. of Technology, Warsaw, Poland

10:50 AM

11:00 AM

TU2A-4: Multi-dimensional Cauchy Method and Adaptive Sampling for an Accurate Microwave Circuit Modeling
S. Peik, Univ. of Waterloo, Waterloo, Ontario, Canada;
R. Mansour, COM DEV Ltd., Cambridge, Ontario,
Canada; Y.L. Chow, City Univ. of Hong Kong,
Hong Kong, P.R. China

11:10 AM

11:20 AM

TU2A-5: Identifying S-parameter Models in the Laplace Domain for High Frequency Multiport Linear Networks
A. Verschuere, Y. Rolain, R. Vuerinckx, G. Vandersteen,
Dept. ELEC/TW, Vrije Universiteit, Brussels, Belgium

11:30 AM

TU2A-6: Multigrid Technique with Local Grid Refinement for Solving Static Field Problems
R. Kulke, T. Sporkmann, I. Wolff, Inst. of Mobile
and Satellite Communication Tech. (IMST),
Kamp-Lintfort, Germany

11:40 AM

TU2A-7: A CAD Algorithm for Coupling between Dielectric Covered MMICs in Multi-chip Assemblies
Z. Wang, R.W. Jackson, Dept. of Elect. and Comp. Engr.,
UMASS Amherst, Amherst, MA

11:50 AM

TU2B mm-wave MMICs for Receiver Applications

Joint RFIC/IMS Session
Chair: H.-C. Huang, AMCOM Communications
Co-chair: M. Kumar, Lockheed-Martin
ROOM 309/310

TU2B-1: GaInP/GaAs HBT Broadband Monolithic Transimpedance Amplifiers and Their High Frequency Small and Large Signal Characteristics
J.-W. Park, S. Mohammadi, D. Pavlidis, Dept. of EECS,
The Univ. of Michigan, Ann Arbor, MI; C. Dua,
J.-C. Garcia, Central Research Lab., Thompson-CSF,
Orsay, France

TU2B-2: K/Ka-band Low-noise Embedded Transmission Line (ETL) MMIC Amplifiers
H.-Q. Tserng, L. Witkowski, A. Ketterson, P. Saunier, RF
Microwave GaAs Prod. Dept., T. Jones, Adv. RF Systems
Dept., Raytheon TI Systems, Dallas, TX

TU2B-3: Integrated 1.55 μm Receivers Using GaAs MMICs and Thin Film InP Detectors
C. Chun, O. Vendier, E. Moon, J. Lasker, N.M. Jokerst,
M. Brooke, H. Ki, School of Elect. and Comp. Engr.,
Georgia Inst. of Technology, Atlanta, GA

TU2B-4: A Ka-band 4-bit Monolithic Phase Shifter Using Unresonated FET Switches
K. Maruhashi, K. Ohata, Kansai Electronics Research
Lab., NEC Corp., Shiga, Japan; H. Mizutani, C&CLSI
Dev. Div., NEC Corp., Kanagawa, Japan

TU2B-5: A Wideband pHEMT Downconverter MMIC for Satellite Communication Systems
C.F. Campbell, Raytheon TI Systems, Dallas, TX

**TU2C RF and Microwave Implications
of Digital TV Broadcasting:**
European, US, Japanese Standards
Focused Session
Chair: G. Marzocchi, DBTA
Room 314/317

TU2D ISM/Cellular/PCS ICs
Joint RFIC/IMS Session
Chair: J. Moniz, IBM
Co-chair: T. Teuksbury, IBM

Room 318/323

TU2E Planar Components
Chair: J. Taub,
Consultant

Room 327/329

10:10 AM

**TU2C-1: Digital Video Broadcasting Standards
for Satellite, Terrestrial and Cable Television
Transmission**
A. Mason, NDS Broadcast, Chilworth, UK

**TU2D-1: A 900 MHz ISM Band Transceiver RFIC
Chipset and RF Module**
C.-K. Lee, C.-C. Ku, K.-L. Su, C.-H. Lin, K.-C. Tao, Ind.
Technology Research Inst., Hsin-Chu, Taiwan, R.O.C.

**TU2E-1: New Coplanar-like Transmission Lines
for Application in Monolithic Integrated mm-wave
and Submm-wave Circuits**
A. Reichelt, I. Wolff, Duisburg Univ.,
Duisburg, Germany

10:30 AM

**TU2C-2: VSB – The American Digital Television
Transmission System**
W.C. Luplow, Zenith Electronics Corp., Glenview, IL

**TU2D-2: GaAs RFICs for CDMA/AMPS Dual-band
Wireless Transmitters**
V. Aparin, K. Gard, G. Klemens, C. Persico,
QUALCOMM Inc., San Diego, CA

**TU2E-2: A Hermetic Coplanar Waveguide to HDI
Microstrip Microwave Feedthrough**
E. Holzman, R. Teti, B. Dufour, S. Miller,
Lockheed-Martin-GES, Moorestown, NJ

10:40 AM

**TU2C-3: Digital Video Broadcasting over Europe:
A Review of Some Satellite Applications**
M. Lopriore, C. Elia, European Space Technology Centre,
Noordwijk, The Netherlands

**TU2D-2: A Bipolar Upconversion Modulation Loop
Transmitter for Dual-band Mobile Communications**
S. Feng, B. Kolb, H. Herrmann, W. Veit, V. Thomas,
S. Herzinger, F. Volpe, G. Lipperer, J. Fenk, Siemens
AG, Munich, Germany

**TU2E-3: W-band Finite Ground Coplanar Waveguide
(FGCPW) to Microstrip Line Transition**
G.P. Gauthier, L.P. Katehi, G.M. Rebeiz, Elect. Engr.
and Comp. Science Dept., Univ. of Michigan,
Ann Arbor, MI

10:50 AM

**TU2C-4: Development of Satellite and Terrestrial Digital
Broadcasting Systems in Japan**
O. Yamada, NHK Science and Technical Research Labs,
Tokyo, Japan

**TU2D-4: IF-band MMICs for High-speed Wireless
Signal Processing**
H. Hayashi, M. Muraguchi, NTT Wireless Sys. Labs.,
Kanagawa, Japan

**TU2E-4: CPS Structure Potentialities for MMICs:
A CPS/CPW Transition and a Bias Network**
D. Prieto, T. Parra, J. Graffeuil, LAAS-CNRS and Univ.
Paul Sabatier, Toulouse, France; J.C. Cayrou,
J.L. Cazaux, ALCATEL TELECOM, Toulouse, France

11:00 AM

**TU2E-5: Micromachined Thick Metal Coplanar
Coupled-line Filters and Couplers**
T.L. Willke, E. Onggosanusi, S.S. Gearhart, Dept.
of Elect. and Comp. Engr., The Univ.
of Wisconsin-Madison, Madison, WI

11:10 AM

**TU2E-6: Original Techniques for Designing Wideband
3D Integrated Couplers**
C. Person, L. Carre, E. Rius, S. Toutain, J.P. Coupez,
LEST ENST de Bretagne/UBO, Brest, France

11:20 AM

**TU2E-7: Simplified Design Technique for High
Performance Microstrip Multi-section Couplers**
D. Lau, L.E. Davis, R. Sloan, Dept. of Elect. Engr.
and Electronics, Univ. of Manchester, Manchester, UK;
S.P. Marsh, GEC-Marconi Materials Tech., Caswell, UK

11:30 AM

**TU2D-5: A High Dynamic Range, Digitally Tuned
Q-enhanced LC Bandpass Filter for Cellular/PCS
Receivers**
W.B. Kuhn, N.K. Yanduru, Kansas State Univ.,
Manhattan, TX; A.S. Wyszynski, Microtune Inc.,
Plano, TX

TU2E-8: MEMS Designed for Tunable Capacitors
H.D. Wu, K.F. Harsh, R.S. Irwin, W. Zhang,
A.R. Mickelson, Y.C. Lee, NSF Center for Adv. Mfg.
and Packaging, Dept. of Mech. Engr. and Dept. of Elect.
and Comp. Engr., Univ. of Colorado, Boulder, CO

11:40 AM

**TU2E-9: Low Loss Air-gap Spiral Inductors for MMICs
Using Glass Microbump Bonding Technique**
J. Chuang, S. El-Ghazaly, Dept. of Elect. Engr.,
Arizona State Univ., Tempe, AZ; N. El-Zein, V. Nair,
G. Maracas, Motorola Inc., Corp. Research Labs,
Tempe, AZ

11:50 AM

TUESDAY

TU3A Modeling and Characterization of FETs and HEMTs

Chair: I. Wolff, Duisburg University
Co-chair: A. Sharma, TRW/S&EG

ROOM 307/308

TU3B Wireless ICs and Circuits

Joint RFIC/IMS Session
Chair: N. Camillieri,
Advanced Micro Devices
Co-chair: M.K. Ravel, Tektronix
ROOM 309/310

TU3C Wireless Components and Systems

Chair: B. Geller,
David Sarnoff Research Center
Co-chair: R. Gupta,
COMSAT Labs
ROOM 314/317

1:20 PM	TU3A-1: A New Analytical and Scaleable Noise Model for HFET R. Reuter, F.J. Tegude, Fraunhofer Inst. for Applied Physics, Freiburg, Germany	TU3B-1: A 2-V Operation RF Front End GaAs MMIC for PHS Hand-set T. Seshita, K. Kawakyu, H. Wakimoto, M. Nagaoka, Y. Kitaura, N. Uchitomi, Toshiba R&D Center, Kawasaki, Japan	TU3C-1: Design and Verification of a SAW Based Chirp Spread Spectrum System M. Huemer, W. Gugler, A. Springer, R. Weigel, Inst. for Comm. and Info. Tech., Univ. of Linz, Linz, Austria; A. Pohl, F. Seifert, Applied Elect. Lab., TU of Vienna, Vienna, Austria
1:30 PM			
1:40 PM	TU3A-2: A Bias and Temperature Dependent Noise Model of Heterojunction Bipolar Transistors R.A. Pucel, RCP Consultants, Needham, MA; T. Daniel, Lucent Technologies; A. Kain, Compact Software; R. Tayrani, Raytheon Co.	TU3B-2: A 1.9 GHz Single-chip RF Front-end GaAs MMIC with Low-distortion Cascode FET Mixer for Personal Handy-phone System Terminals M. Nakayama, K. Horiguchi, K. Yamamoto, Y. Yoshii, S. Sugiyama, N. Suematsu, T. Takagi, Info. Technology R&D Center, Mitsubishi Electric Corp., Kanagawa, Japan	TU3C-2: The Implementation of RTU and RSU Transceiver for WLL System Y.-J. Chong, I.-K. Lee, S.-G. Kang, B.-K. Kim, H.-J. Hong, Radio Technology Section, ETRI, Taejeon, Korea
1:50 PM	TU3A-3: Technology Independent Degradation of Minimum Noise Figure Due to Pad Parasitics C.E. Biber, M.L. Schmatz, T. Morf (Elect. Lab.), Lab. for Electromagnetic Fields and Microwave Elect., Swiss Fed. Inst. of Technology (ETH), Zurich, Switzerland; E. Morifuji, Toshiba Corp., Kawasaki, Japan		
2:00 PM	TU3A-4: Robust, Model-independent Generation of Intrinsic Characteristics and Multi-bias Parameter Extraction for MESFETs/HEMTs A. Ghazinour, R.H. Jansen, RWTH Aachen Univ. of Technology, EE Dept., Aachen, Germany	TU3B-3: A Monolithic Even Harmonic Quadrature Mixer Using a Balance Type 90 Degree Phase Shifter for Direct Conversion Receivers M. Shimozawa, K. Kawakami, H. Ikematsu, K. Itoh, N. Kasai, Y. Isota, O. Ishida, Info. Technology R&D Center, Mitsubishi Electric Corp., Kanagawa, Japan	TU3C-3: Ultrafast Analog-to-digital Converter Using Resonant Tunneling Ternary Quantizers T. Itoh, T. Waho, J. Osaka, H. Yokoyama, M. Yamamoto, NTT Systems Electronics Labs., Kanagawa, Japan
2:10 PM			
2:20 PM	TU3A-5: Comparison of Quasi-2D and Ensemble Monte Carlo Simulations for Deep Sub-micron HEMTs C.G. Morton, Hewlett-Packard Co., Santa Rosa, CA; C.M. Snowden, Univ. of Leeds, Leeds, UK	TU3B-4: An 18 GHz Si Bipolar Mold Package Prescaler M. Mineo, M. Okamoto, K. Hosoki, H. Ohba, NEC Corp., Yokohama, Japan	TU3C-4: Intelligent RF Power Module Using Automatic Bias Control (ABC) System for PCS CDMA Applications T. Sato, Hatachi Semicond. America Inc., Brisbane, CA; S. Yuyama, A. Nakajima, H. Ono, C. Kusano, Radio Freq. Device Engr. Dept., Hitachi, Kodaira, Japan; A. Iwai, E. Hase, Central Res. Lab., Hitachi, Tokyo, Japan
2:30 PM			
2:40 PM	TU3A-6: Extrinsic Elements Extraction of DGMESFET W.-K. Deng, T.-H. Chu, Dept. of Elect. Engr., National Taiwan Univ., Taipei, Taiwan	TU3B-5: A Q-factor Enhancement Technique for MMIC Inductors M. Danesh, J.R. Long, Univ. of Toronto, Toronto, Ontario, Canada; R.A. Hadaway, Nortel Tech., Ottawa, Ontario, Canada; D.L. Hareme, IBM Microelectronics, Burlington, VT	TU3C-5: A 900 MHz HBT Power Amplifier MMIC with 55% Efficiency at 3.3 V Operation H. Asano, S. Hara, S. Komai, VLSI Development Labs., Sharp Corp., Nara, Japan
2:50 PM	TU3A-7: A Systematic Scheme for Power Amplifier Design Using Multi-harmonic Loadpull Simulation Technique Q. Cai, J. Gerber, S. Peng, Ansoft Corp./Compact Software Div., Elmwood Park, NJ		

TU3D mm-wave MMIC Technology		TU3E Waveguide Components	
Joint RFIC/IMS Session		Chair: S.M. Saad,	
Chair: M. Kumar, Lockheed-Martin		The Aerospace Corporation	
Co-chair: H.-C. Huang,			
AMCOM Communications			
Room 318/323		Room 327/329	
1:20 PM	TU3D-1: <i>A 44 GHz InP-based HBT Double-balanced Amplifier with Novel Current Re-use Biasing</i> K.W. Kobayashi, M. Nishimoto, L.T. Tran, H. Wang, J. Cowles, T.R. Block, J. Elliot, B. Allen, A.K. Oki, D.C. Streit, TRW Electronics Sys. and Technology Div., Redondo Beach, CA		TU3E-1: <i>Generalized Multilayer Anisotropic Dielectric Resonators</i> C. Wang (now with CELWAVE, Marlboro, NJ), K.A. Zaki, Elect. Engr. Dept., Univ. of Maryland, College Park, MD
1:30 PM			
1:40 PM	TU3D-2: <i>A 60 GHz 256 QAM Balanced Vector Modulator for Short Range LOS Communication Applications</i> S. Nam, A.E. Astiani, G. Passiopoulos, I.D. Robertson, Dept. of Elect. Engr., King's College, Strand, London, UK, S. Lucyszyn, Dept. of Electronic and Elect. Engr., Univ. of Surrey, Guildford, Surrey, UK		TU3E-2: <i>Attenuation and Power-handling Capabilities of Generalized Ridge Waveguides</i> Y. Rong, K.A. Zaki, Elect. Engr. Dept., Univ. of Maryland, College Park, MD
1:50 PM			
2:00 PM			TU3E-3: <i>Automated Design of a Novel Dual Mode Coupler for Compact Dual Polarization Beam Forming Networks</i> F. Alessandri, R. Sorrentino, M. Schioccola, L. Vanni, Inst. of Electronics, Univ. of Perugia, Perugia, Italy
2:10 PM	TU3D-3: <i>A Single 94-GHz Frequency Source Using InP-based HEMT-HBT Integration Technology</i> H. Wang, R. Lai, L. Tran, J. Cowles, Y.C. Chen, E. Lin, H.H. Liao, M.K. Ke, T. Block, H.C. Yen, TRW Space and Electronics Group, Redondo Beach, CA		
2:20 PM			TU3E-4: <i>Coaxial-probe to Parallel-plate Dielectric Waveguide Transition: Analysis and Experiment</i> G.K.C. Kwan, N.K. Das, Dept. of Elect. Engr., Polytechnic Univ., Farmingdale, NY
2:30 PM	TU3D-4: <i>Fully Integrated Q-band MMIC Transmitter and Receiver Chips Using Resistive PHEMT Mixers</i> S.Nam, T. Gokdemir, A.H. Baree, I.D. Robertson, Dept. of Electronic & Elect. Engr., King's College, Strand, London, UK; A.D. Plews, M.J. Howes, C.M. Snowden, Univ. of Leeds, UK; J.G. Leckey, A.D. Patterson, J.A.C. Stewart, Queens Univ. of Belfast, N. Ireland		TU3E-5: <i>A Novel Wideband TM01-to-TE11 Mode Converter</i> R.L. Eisenhart, Eisenhart & Associates, Woodland Hills, CA
2:40 PM			TU3E-6: <i>Wideband Crossed-guide Waveguide Couplers</i> P. Meyer, J.C. Kruger, Dept. of Electronic Engr., Univ. of Stellenbosch, Stellenbosch, South Africa
2:50 PM	TU3D-5: <i>Low Cost GaAs PHEMT MMICs for mm-wave Sensor Applications</i> H.J. Siwerius, A.Werthof, H. Tisher, U.Schaper, W. Kellner, Siemens AG, Corp. Technology, Munich, Germany; A. Schafer, G. Bock, TU Berlin, Germany; L.Verwey, Fraunhofer Inst., Freiburg, Germany; T. Grave, Siemens AG Semiconductor Group, Munich, Germany		TU3E-7: <i>A Novel Coplanar Transmission Line to Rectangular Waveguide Transition</i> W. Simon, M. Werthen, I. Wolff, IMST, Inst. of Mobile and Satellite Comm. Tech., Kamp-Lintfort, Germany

TU4A Nonlinear Simulation and Modeling

Chair: R. Goyal,
Airway Communications Inc.
Co-chair: R.H. Janson,
Aachen Univ. of Eng. Tech
 ROOM 307/308

TU4B Multi-function MMW ICs

Joint RFIC/IMS Session
Chair: Z. Bardai,
Raytheon Systems Co.
Co-chair: H.A. Hung, TRW
 ROOM 309/310

TU4C Low Power RF/Microwave and mm-wave Wireless Technologies

Focused Session
Chair: T. Itoh, UCLA
Co-chair: J. Harvey, ARO
 ROOM 314/317

3:30 PM

TU4A-1: *Global Modeling of Microwave Devices Using Wavelets*
 M. Toupikov, G. Pan, S. El-Ghazaly,
 Dept. of Elect. Engr., Arizona State Univ., Tempe, AZ

TU4B-1: *A 44 GHz Low Noise Block Downconverter MMIC Suitable for EHF Satellite Communication Applications*
 A.R. Barnes, D.C. Bannister, M.T. Moore,
 Defense Evaluation Research Agency, Malvern, UK

TU4C-1: *The Low Power Electronics Multidisciplinary Research Initiatives (MURIs)*
 J. Harvey, ARO, Research Triangle Pk., NC

3:40 PM

TU4C-2: *Microwave Amplifier Low Power Considerations*
 R. Trew, DDRE, Arlington, VA

3:50 PM

TU4A-2: *Nonlinear Transient Simulation of Embedded Subnetworks Characterized by S-parameters Using Complex Frequency Hopping*
 R. Achar, M. Nakhala, E. Ahmed, Dept. of Electronics,
 Carleton Univ., Ottawa, Ontario, Canada

TU4B-2: *A Highly Integrated Multi-function Chip-set for Low Cost Ka-band Transceiver*
 D.L. Ingram, L. Sjogren, J. Kraus, M. Nishimoto,
 M. Siddiqui, S.K. Cha, D.I. Stones, M. Huang, R. Lai,
 TRW, Electronic Systems and Technology Div.,
 Redondo Beach, CA

TU4C-3: *Low Voltage Electronics for Portable Wireless Applications: An Industrial Perspective*
 M. Golio, Rockwell-Collins, Avionics
 and Communications, Cedar Rapids, IA

4:00 PM

TU4A-3: *Chaos Detection in Microwave Circuits Using Harmonic Balance Commercial Simulators*
 A. Suárez, Dept. Engr. Comm., Univ. of Cantabria,
 Santander, Spain, J.-M. Collantes, Electricity
 and Electronics Dept., Univ. of the Basque Country,
 Bilbao, Spain

TU4B-3: *A V-band Single Chip Direct Carrier BPSK Modulation Transmitter with Integrated Patch Antenna*
 G. Passiopoulos, S. Nam, A. Georgiou, A. E. Ashtiani,
 I.D. Robertson, Dept. of Electronic Engr., King's
 College, Univ. of London, London, UK, E.A. Grindrod,
 Def. and Eval. Res. Agency (DERA), Malvern, UK

TU4C-4: *Nonlinear Effects of Power Amplification on Multicarrier Spread Spectrum Systems*
 V. Borich, J.-H. Jong, J. East, W.E. Stark,
 Dept. of Elect. Engr. and Comp. Science,
 The Univ. of Michigan, Ann Arbor, MI

4:20 PM

TU4A-4: *A New Approach for the Extraction of Spice Compatible Models from Measured S-parameters of Microwave Circuits*
 J.M. Gomez, E.U. Politécnica, Univ. de Alcalá,
 Madrid, Spain, J.L. Alonso, Univ. Politecnica de
 Madrid, Madrid, Spain

TU4B-4: *A Ka-band Monolithic Single-chip Transceiver Using Sub-harmonic Mixer*
 Y.-L. Kok, A. Morteza, H. Wang, B. Allen, T.S. Lin,
 TRW, Space and Elect. Group., Redondo Beach, CA

TU4C-5: *Device and Circuit Approaches for Improved Linearity and Efficiency in Microwave Transmitters*
 P.M. Asbeck, L. Milstein, G. Hanington, P.F. Chen,
 D.W. Lee, J. Arun, Univ. of California, San Diego,
 La Jolla, CA, T. Itoh, Y. Qian, M.F. Chang, V. Schulz,
 Univ. of California, Los Angeles, CA

4:30 PM

TU4A-5: *New Extraction Method for FET Extrinsic Capacitances Using Active Bias Conditions*
 F. Lenk, R. Doerner, Ferdinand-Braun-Institut,
 Berlin, Germany

4:40 PM

TU4A-6: *New Versatile Model: Accurate Prediction and Synthesis Ability for Arbitrary Geometry FET*
 J. Dubouloy, J.F. Villemazet, V. Grognet, M. Soulard,
 ALCATEL Telecom LEMMIC, Nanterre, France,
 D. Pasquet, E. Bourdel, ENSA EMO,
 Cergy-Pontoise, France

TU4B-5: *mm-wave Three-dimensional Masterslice MMICs*
 K. Nishikawa, K. Kamogawa, T. Tokumitsu, I. Toyoda,
 NTT Wireless Systems Lab., K. Inoue, K. Onodera,
 M. Hirano, NTT Systems Elect. Labs., Kanagawa, Japan

TU4C-6: *MEMS and Si-micromachined Components for Low-power, High-frequency Communications Systems*
 L.P.B. Katehi, G.M. Rebeiz, C.T.-C. Nguyen,
 Univ. of Michigan, Ann Arbor, MI

4:50 PM

TU4A-7: *Small-signal Distributed FET Modeling Through Electromagnetic Analysis of the Extrinsic Structure*
 A. Cidronali, G. Collodi, Dept. Electronics Engr.,
 Univ. of Florence, Florence, Italy, A. Santarelli,
 G. Vannini, Dept. Electronics, Comp. Sci. and Systems,
 Univ. of Bologna, Bologna, Italy

5:00 PM

TU4A-8: *Reliable Extraction of Small-signal Elements of a Generalized Distributed FET Model*
 G. Kompa, Univ. of Kassel, Kassel, Germany

TU4D Transceiver ICs*Joint RFIC/IMS Session**Chair: S. Kiaei, Motorola Inc.**Co-chair: D. Lovelace, Motorola Inc.*

ROOM 318/323

**TU4E Wireless Satellite Applications
of Superconductivity***Chair: C. Jackson, TRW**Co-chair: A. Fathy, Sarnoff Corp.*

ROOM 327/329

TU4D-1: X-band Si Bipolar Transistor Single-chip Transceiver Using Three-dimensional MMIC Technology
I. Toyoda, K. Nishikawa, K. Kamogawa, T. Tokumitsu, NTT Wireless Systems Labs., Kanagawa, Japan;
C. Yamaguchi, M. Hirano, K. Onodera, NTT System Electronics Labs.

TU4E-1: High-Q Tunable YBaCuO Disk Resonator Filters for Transmitter Combiners in Radio Base Stations
B.A. Aminov, A. Baumfalk, H.J. Chaloupka, M. Hein, S. Kolesov, H. Piel, Cryoelectra GmbH, Wuppertal, Germany; T. Kaiser, Univ. of Wuppertal, Germany; H. Medelius, Ericsson Radio, Stockholm, Sweden; E. Wikborg, Ericsson Comp, Stockholm, Sweden

TU4D-2: Direct Conversion for FLEX Paging Receivers – A Feasibility Study
Z. Chen, J. Lau, Elect. and Electronic Engr. Dept., Hong Kong Univ. of Sci. and Technology, Kowloon, Hong Kong, P.R. China

TU4E-2: 8-pole Superconducting Quasi-elliptic Function Filter for Mobile Communication Applications
J.-S. Hong, M.J. Lancaster, School of Elect. and Electronic Engr., Univ. of Birmingham, Birmingham, UK, D. Jedamzik, GEC Marconi Materials Technology Ltd., Borehamwood, UK; R.B. Greed, GEC Marconi Research Center, Great Baddoe, Chelmsford, UK

TU4D-3: A SiBJT RF Dual Band Receiver IC for DAB
W. Titus, Analog Devices, Inc., NJ/Design Center, Somerset, NJ; R. Croughwell, L. Devito, Analog Devices, RSTC, Wilmington, MA; C. Schiller, Commquest Inc., Auburn, CA

TU4E-3: Direct Synthesis of Tubular Bandpass Filters with Frequency-dependent Inductors
Q. Huang, J. Liang, D. Zhang, G.-C Liang, Conductus Inc., Sunnyvale, CA

TU4D-4: A Low Voltage RF Receiver for Digital Satellite Radio
G. Cali, G. Cantone, P. Filoramo, G. Sirna, P. Vita, SGS-Thomson Microelectronics, Catania, Italy; G. Palmisano, Univ. of Catania, Fac. of Engr., Catania, Italy

TU4E-4: A Satellite Repeater Comprising Superconducting Filters
T. Kasser, M. Klauda, C. Neumann, E. Guha, R. Bosch, GmbH, Stuttgart, Germany; S. Kolesov, A. Baumfalk, H. Chaloupka, Univ. of Wuppertal, Wuppertal, Germany

TU4D-5: A Si BJT IF Downconverter/AGC IF for DAB
M. Goldfarb, R. Croughwell, G. Heiter, Analog Devices Inc., Wilmington, MA; C. Schiller, D. Livezey, Commquest Technologies Inc., Auburn, CA

TU4E-5: Novel Superconducting Ring Filter
G. Tsuzuki, M. Suzuki, N. Sakakibara, Y. Ueno, Advanced Mobile Telecom. Technology Inc., AichOken, Japan

TU4D-6: RF Micromachined Varactors with Wide Tuning Range
A. Dec, K. Suyama, Dept. of Elect. Engr., Columbia Univ., New York, NY

The MTT-S Student Paper Competition encourages and recognizes excellence in research in microwave science and technology. There were 71 accepted student papers this year. These were down selected to 29 finalists for the Student Paper Competition by the Technical Program Committee. All accepted student papers will be presented at their normal paper session. The 29 student finalists will also present their paper at a student open forum from 2 to 5 Tuesday afternoon and 8 to 10 Wednesday morning. All Symposium attendees are welcome to visit these sessions. Judging will occur at these times.

TU2B-1: GaInP/GaAs HBT Broadband Monolithic Transimpedance Amplifiers and Their High Frequency Small and Large Signal Characteristics

J.-W. Park, Dept. of EECS, The Univ. of Michigan, Ann Arbor, MI

TU2B-3: Integrated 1.55 μm Receivers Using GaAs MMICs and Thin Film InP Detectors

C. Chun, School of Elect. and Comp. Engr., Georgia Inst. of Technology, Atlanta, GA

TU2E-3: W-band Finite Ground Coplanar Waveguide (FGCPW) to Microstrip Line Transition

G.P. Gauthier, Elect. Engr. and Comp. Science Dept., Univ. of Michigan, Ann Arbor, MI

WE1A-2: Broadband, Fixed-tuned, mm-wave Balanced Frequency Doublers

D.W. Porterfield, Dept. of Elect. Engr., Univ. of Virginia, Charlottesville, VA

WE2A-4: 80 GHz Distributed Amplifiers with Transferred-substrate Heterojunction Bipolar Transistors

B. Agarwal, Dept. of Elect. and Comp. Engr., Univ. of California, Santa Barbara, CA

WE2D-4: A Physically-based Transient SPICE Model for GaAs MESFETs

R.E. Leoni III, Lehigh Univ., Bethlehem, PA

WE3D-1: Simulation of Multi-tone IMD Distortion and Spectral Regrowth Using Spectral Balance

N.B. de Carvalho, Univ. de Aveiro, Aveiro, Portugal

WE3D-5: Validation of a New Nonlinear HEMT Model by Intermodulation Characterization

G. Qu, Electronics Dept., Macquarie Univ., Sydney, Australia

WE3E-2: Study on Diagnosis for Tooth Using Millimeter Waves

N. Hoshi, School of Elect. Engr., Nat. Defense Academy, Yokosuka, Japan

WE1F-08: A New Enhanced Coupling Structure of Ring Resonator with Two Coupled Lines and a Slit

J.-Y. Park, Dept. of Radio Science and Engr., Kwangwoon Univ., Seoul, Korea

WE1F-32: Modification of the 3D-TLM Scattering Matrix to Model Nonlinear Devices in Graded and Heterogeneous Regions

L. Cascio, Dept. of Elect. and Comp. Engr., Univ. of Victoria, Victoria, BC, Canada

WE1F-33: Simple Equivalent Circuit Modeling of Small Apertures in Transmission Line Matrix (TLM) Method

G. Tardioli, Dept. of Elect. and Comp. Engr., Univ. of Victoria, Victoria, BC, Canada

WE1F-56: A 94 GHz Aperture-coupled Micromachined Microstrip Antenna

G.P. Gauthier, Elect. Engr. and Comp. Science Dept., Univ. of Michigan, Ann Arbor, MI

WE1F-57: Novel Active Antenna Amplifying Arrays

Y.-C. Yang, Dept. of Elect. Engr., Texas A&M Univ., College Station, TX

Prizes are awarded for the best papers. All student awardees are given certificates and complimentary tickets to the Awards Banquet. In addition to cash awards donated by MTT-S in the amount of \$1900, additional prizes for this year's contest are provided through a generous donation from Hewlett-Packard Company. These sessions will feature the brightest young engineering talent currently emerging from outstanding universities.

TH1C-7: InP-based Gilbert Cell Phase Detector for Generation of Stable Dense Wavelength Division Multiplexing Channel Offsets Using an Optical Phase-locked Loop

P.G. Goetz, Dept. of Elect. Engr. and Comp. Sci., Univ. of Michigan, Ann Arbor, MI

TH2C-6: All-optically Controlled Beam-scanning Array for Antenna Remoting Applications

W.R. Deal, Univ. of California, Los Angeles, CA

TH2D-1: Formulation of a Haar-wavelet-based Multi-resolution Analysis Similar to the 3-D FDTD Method

M. Fujii, Dept. of Elect. and Comp. Engr., Univ. of Victoria, Victoria, BC, Canada

TH2D-5: A Systematic Approach to the Problem of Equivalent Circuit Model Generation

T. Mangold, Inst. fur Hochfrequenztechnik, TU Munchen, Munchen, Germany

TH2E-1: A Modified Feed-forward Technique for Mixer Linearization

T.J. Ellis, The Radiation Lab., Univ. of Michigan, Ann Arbor, MI

TH3A-2: 20 Watt Spatial Power Combiner in Waveguide

N.-S. Cheng, Dept. of Elect. and Comp. Engr., Univ. of California, Santa Barbara, CA

TH3C-1: Broadband mm-wave Fiber-radio Network Incorporating Remote Up/Downconversion

G.H. Smith, Dept. of Elect. and Electronic Engr., Univ. of Melbourne, Melbourne, Australia

TH3E-1: Micromechanical Electrostatic K-band Switches

S. Pacheco, Radiation Lab., Elect. Engr. and Comp. Sci. Dept., Univ. of Michigan, Ann Arbor, MI

TH4A-5: Broadband Power Amplifier Integrated with Slot B Antenna and Novel Harmonic Tuning Structure

V. Radisic, Elect. Engr. Dept., Univ. of California, Los Angeles, CA

TH4B-1: 50 GHz Interconnect Design in Standard Silicon Technology

B. Cleveland, Center for Integrated Systems, Stanford Univ., Stanford, CA

TH1F-18: Development of Cryogenic Load-pull Analysis: Power Amplifier Technology Performance Trends

E. Gebara, School of Elect. and Comp. Engr., Georgia Inst. of Technology, Atlanta, GA

TH1F-58: Development of Vertical Interconnect Surface Mount Packages

H. Liang, Sch. of Elect. and Comp. Engr., Georgia Inst. of Technology, Atlanta, GA

II-1: K-band Si/Ge HBT MMIC Amplifiers Using Lumped Passive Components with a Micromachined Structure

L.-H. Lu, Univ. of Michigan, Dept. of Elect. Engr. and Comp. Science, Ann Arbor, MI

II-2: A 1-157 GHz InP HEMT Traveling Wave Amplifier

B. Agarwal, Univ. of CA Santa Barbara, Dept. of Elec. and Comp. Engr., Santa Barbara, CA

VII-1: Interference Issues in Silicon RFIC Design

Z. Zhang, Hong Kong Univ. of Science and Tech., Dept. of EE, P.R. China

WEDNESDAY PANEL SESSION

PWED4: MICROELECTROMECHANICAL SYSTEMS (MEMS) FOR MICROWAVE AND MILLIMETER-WAVE APPLICATIONS

Date: Wednesday, June 10, 1998
Time: 12:00–1:15 PM
Location: Baltimore Convention Center, Room 339/342
Sponsor: MTT-12, Microwave and Millimeter-wave Packaging
Organizers: Y.C. Lee, University of Colorado - Boulder
Rick L. Sturdivant, Hughes Aircraft Company
Moderator: Y.C. Lee
Panelists: Masayoshi Esashi, Tohoku University
Charles L. Goldsmith, Raytheon TI Systems
Clark T.-C. Nguyen, University of Michigan
R.Y. Loo, Hughes Aircraft Company
Y.C. Lee

Microelectromechanical systems (MEMS) use low-cost, precision, batch-processing techniques to fabricate thousands of micro circuits, switches, variable capacitors, filters, resonators and other novel devices from a single silicon wafer. The MEMS-based radio frequency (RF) components will result in low-cost, high-performance, high-reliability, tunable systems. This panel session will provide a forum to review industry/university R&D activities on RF MEMS for microwave and millimeter-wave applications. The panelists are leaders in MEMS or RF MEMS, and will address the following issues:

- a) What is the trend of general MEMS technologies and applications?
- b) What are the RF MEMS activities for microwave and mm-wave applications?
- c) What are the leading academic research concepts for RF MEMS?
- d) What are the leading industrial studies for commercialization of RF MEMS?
- e) What are the foundry services available to prototype RF MEMS?

THURSDAY PANEL SESSIONS

PTHU5: RELIABILITY WITHOUT HERMITICITY (RWOH)

Date: Thursday, June 11, 1998
Time: 12:00–1:15 PM
Location: Baltimore Convention Center, Room 324/326
Sponsor: MTT-12, Microwave and Millimeter-wave Packaging
Organizer: John Wooldridge, TRW
Moderator: John Wooldridge
Panelists: Nick Jensen, MACOM
Zaher Bardai, Hughes Aircraft
Doug Lockie, Endgate
Harvey Rogers, TRW
Mark Hauhe, Hughes Aircraft

The hermiticity specification has required electronic substrates to be laser or seam sealed in a metal box. This requirement has restricted microelectronics package design and resulted in increased package and testing costs. Recently, military and commercial microwave and mm-wave applications are fielding lower cost packages that are not hermetic. These new package designs provide barriers to moisture penetration at the chip level or at the package level. The panelists will present their individual solutions to RWOH and their field or environmental tests that demonstrate the required reliability.

PTHU6: ADVANCED MULTIFUNCTIONAL RF SYSTEMS (AMRFS)

Date: Thursday, June 11, 1998
Time: 12:00–1:15 PM
Location: Baltimore Convention Center, Room 339/342
Sponsor: MTT-16, Microwave Systems
Organizers: Max Yoder, Office of Naval Research
Marina Burgstahler, Naval Air Systems Team
Moderator: Max N. Yoder
Panelists: Max Yoder
Marina Burgstahler
Paul Hughes, Naval Research Lab
Joe Jensen, Hughes Aircraft

Advanced Multifunctional RF Systems (AMRFS) are under development wherein the objective is to radiate (or receive) multiple simultaneous beams of RF energy. Each beam is given independent control of its power, frequency, modulation, shape, bearing and elevation. Functionality of each beam (e.g., surveillance, EW, weapon control, communications) is independently controlled in real time as the environmental scenario dictates. True time increment beam forming, signal synthesis and broadband modulation are digitally derived. Initial feasibility demonstrations will employ current technology while 100 GHz logic technology will eventually provide full implementation. Life cycle cost savings up to \$75 M per ship are envisioned.

WE1A mm/Sub mm-wave Mixers and Multipliers

Chair: K. Agarwal, Raytheon Systems
Co-chair: A. Riddle, Macallan Consulting
 ROOM 307/308

WE1B Historical Perspective on Microwave Systems in the Baltimore/Washington Area

Focused Session
Chair: M. Skolnik, NRL, Retired
 ROOM 309/310

WE1C Power Amplifier Technology for Wireless Applications

Chair: J. Heaton, Sanders, a Lockheed Martin company
Co-chair: K. Ikossi-Anastasiou, LSU
 ROOM 314/317

8:00 AM

WE1A-1: Novel mm-wave Active MMIC Triplers
 H. Fudem, E. Niehenke, Northrop Grumman ESSD, Baltimore, MD

WE1B-1: Westinghouse Microwave Systems and Technology
 G. Strull, Westinghouse Elect. Systems, Retired, Baltimore, MD

WE1C-1: A 1.9 GHz Fully Integrated PHS Power Amplifier with a Novel Automatic Gate-biased Control Circuit
 R. Singh, K.-S. Tan, Inst. of Microelectronics, Singapore; H. Nakamura, OKI Techno Centre, Singapore, J. Shibata, OKI Electric Ind. Co., Tokyo, Japan

8:20 AM

WE1A-2: Broadband, Fixed-tuned, mm-wave Balanced Frequency Doublers
 D.W. Porterfield, T.W. Crowe, Dept. of Elect. Engr., Univ. of Virginia, Charlottesville, VA; R.F. Bradley, NRAO, Charlottesville, VA; N.R. Erickson, UMASS Amherst, Amherst, MA

WE1B-2: Early Work on Millimeter Wave Systems and Phased Arrays
 C.M. Johnson, Mitre Corp., Arlington, VA

WE1C-2: 63.2% High Efficiency and High Linearity Two-stage InGaP/GaAs HBT Power Amplifier for Personal Digital Cellular Phone System
 T. Iwai, S. Ohara, T. Miyashita, K. Joshin, Fujitsu Labs., Atsugi, Japan

8:30 AM

WE1A-3: mm-wave GaAs Monolithic Multipliers
 J. Papapolymerou, J. East, L. Katehi, EECS Dept., Univ. of Michigan, Ann Arbor, MI; M. Kim, I. Mehdi, Jet Prop. Lab., Pasadena, CA

WE1C-3: 64% Efficient Enhancement-mode Power Heterojunction FET for 3.5V Li-ion Battery Operated Personal Digital Cellular Phones
 Y. Bito, N. Iwata, M. Tomita, Kanasi Elect. Research Labs., NEC Corp., Shiga, Japan

8:40 AM

WE1A-4: Progress Towards the Realization of MMIC Technology at Submillimeter Wavelengths: A Frequency Multiplier to 320 GHz
 J. Bruston, R.P. Smith, S.C. Martin, P.H. Siegel, California Institute of Technology, Jet Prop. Lab., Pasadena, CA

WE1B-3: Commercial and Non-military Government Space Applications of Microwaves
 G. Hyde, COMSAT Corp., Retired, Rockville, MD

WE1C-4: A High Efficiency GaAs Power Amplifier Module with a Single Voltage for Digital Cellular Phone Systems
 M. Nishida, S. Murai, H. Uda, H. Tominaga, T. Sawai, A. Ibaragi, SANYO Electric Co. Ltd., Microelectronics Research Ctr., Ooka, Japan

8:50 AM

WE1C-5: 3.5V Operation Driver-amplifier MMIC Utilizing SrTiO₃ Capacitors for 1.95 GHz Wide-band CDMA Cellular Phones
 T.B. Nishimura, N. Iwata, K. Yamaguchi, Kansai Elect. Research Labs., NEC Corp., Shiga, Japan; K. Takemura, Y. Miyasaka, Fund. Research Labs, NEC Corp.

9:00 AM

WE1A-5: An All Solid-state 640 GHz Subharmonic Mixer
 I. Mehdi, P.H. Siegel, D.A. Humphry, T.H. Lee, R.J. Dengler, J.E. Oswald, A. Pease, R. Lin, JPL, Pasadena, CA; H. Eisele, Univ. of Michigan, Ann Arbor, MI; R. Zimmermann, Radiometer Physics, Meckenheim, Germany; N. Erickson, UMASS, Amherst, MA

WE1B-4: The Origins of the Proximity Fuse
 L. Brown, Carnegie Inst. of Washington, Washington, DC

WE1C-6: Performance of RFMOS for 1.9 GHz CDMA Operation
 F. Brauchler, D. Seymour, A. Khatibzadeh, J. Erdljac, J. Arch, Texas Instruments, Dallas, TX; M. Tutt, Raytheon TI Systems, Dallas, TX

9:10 AM

WE1C-7: High Efficiency Mode "E" Amplifier Powers High Efficiency Active Transmitting Patch Antenna
 F.J.O. Gonzalez, V.G. Posadas, J.L.J. Martin, E.U.I.T. Telecom. D.I.A.C.; A.A. Lopez, E.T.S.I. Telecom. S.S.R. (G.M.R.), Politechnical Univ. of Madrid, Madrid, Spain; C.M. Pascual, Univ. Carlos III

9:20 AM

WE1A-6: A 640 GHz Planar-diode Fundamental Mixer/Receiver
 P.H. Siegel, I. Mehdi, R.J. Dengler, T.H. Lee, D.A. Humphry, A. Pease, California Inst. of Technology, JPL, Pasadena, CA; R. Zimmermann, P. Zimmerman, Radiometer Physics, Meckenheim, Germany

9:30 AM

WE1D Time Domain Methods, I

*Chair: P. Russer,
University of Technology–Munich
Co-chair: L.P.B. Katehi,
University of Michigan
Room 318/323*

WE1E SAW Systems and Sensors

*Chair: K. Anemogiannis,
SAWTEK*

Room 327/329

8:00 AM

WE1D-1: Stable and Efficient ABCs for Graded Mesh FDTD Simulations
A. Lauer, I. Wolff, Inst. of Mobile and Satellite Comm. Tech., Kamp-Lintfort, Germany

WE1E-1: A Robust Ultra Broadband Wireless Communication System Using SAW Chirped Delay Lines
A. Springer, W. Gugler, M. Huemer, R. Weigel, Inst. for Comm. and Info. Engr., Univ. of Linz, Austria; A. Pohl, F. Seifert, Appl. Engr. Lab., TU of Vienna, Vienna, Austria; L. Reindel, C.C.W. Ruppel, Siemens AG Corp. R&D Center, Munich, Germany

8:20 AM

WE1D-2: Adapted Radiating Boundaries (ARB) for Efficient Time Domain Simulation of Electromagnetic Interferences
S. Lindenmeier, L. Pierantoni, P. Russer, Lehrstuhl für Hochfrequenztechnik, TU München, München, Germany

WE1E-2: Performance Degradation in GPS-Receiver Caused by Group Delay Variations of SAW-Filters
T. Mueller, Daimler-Benz Research, Ulm, Germany

8:30 AM

WE1E-3: Miniature SAW Antenna Duplexer Module for 1.9 GHz PCN Systems Using SAW-resonator-coupled Filters
N. Shibagaki, M. Hikita, Central Research Lab., Hitachi Ltd., Tokyo, Japan; K. Sakiyama, Hitachi Media Electronics, Yokohama, Japan

8:40 AM

WE1D-3: Unsplit-field Formulations for Generalized Material Independent PML Absorbers
A.P. Zhao, Electronics Lab., Nokia Research Center, Nokia Group, Finland

8:50 AM

WE1D-4: An Interface for the FDTD Diakoptics
T. Shibata, M. Tomizawa, NTT System Electronics Lab., Kanagawa, Japan

WE1E-4: New Applications of Wireless Interrogable Passive SAW Sensors
A. Pohl, F. Seifert, Appl. Electronics Lab., Univ. of Technology, Vienna, Austria; A. Springer, R. Weigel, Univ. of Linz, Linz, Austria; L. Reindel, Siemens AG, Corp. R&D Center, Munich, Germany

9:00 AM

WE1D-5: A Novel 2-D Multi-mode Parallel Time Domain Diakoptics and Its Application in Filter Analysis and Design
D. Su, H.-S. Park, Y. Qian, T. Itoh, Dept. of Elect. Engr., Univ. of California, Los Angeles, CA; B. Houshmand, Jet Propulsion Lab., Pasadena, CA

9:10 AM

WE1E-5: A Chirp Spread Spectrum DPSK Modulator and Demodulator for Time Shift Multiple Access Communication Systems by Using SAW Devices
Y. Takeuchi, Lab. Japan Radio Co. Ltd., Saitama, Japan; K. Yamanouchi, Research Inst. of Elect. Comm., Tohoku Univ., Sendai, Japan

9:20 AM

WE1D-6: Space Adaptive Analysis of Evanescent Waveguide Filters
E.E. Tentzeris, L.P.B. Katehi, Radiation Lab., Univ. of Michigan, Ann Arbor, MI

WE1E-6: Novel Nonlinear FMCW Radar for Precise Distance and Velocity Measurements
M. Vossiek, T.v. Kerssenbrock, P. Heide, Siemens AG, Corporate Technology Dept., Munich, Germany

9:30 AM

WE1D-7: Time-domain Vector-potential Analysis of Complex RF Multilayered Structures via Segmentation Technique
N. Georgieva, Z. Chin, Dept. of Elect. and Comp. Engr., DalTech Dalhousie Univ., Halifax, Nova Scotia, Canada; W. Oberhammer, Nortel/Northern Telecom, Ottawa, Ontario, Canada

WEDNESDAY

WE2A mm-wave Technology and Applications*Chair: J. Wiltse,**GA Tech Research Institute**Co-chair: J.W. Dees, GA Inst. of Technology*

ROOM 307/308

WE2B Microwave and Wireless Education in a Rapidly Changing Environment*Focused Session**Chair: R. Caverly,**Villanova University*

ROOM 309/310

WE2C Microwave Power Amplifiers*Chair: L.J. Kushner,**MIT Lincoln Lab**Co-chair: B. Bayraktaroglu,**Northrop Grumman*

ROOM 314/317

10:10 AM

WE2A-1: A W-band Dielectric-lens-based Integrated Monopulse Radar Receiver

S. Raman, N.S. Barker, G.M. Rebeiz, Radiation Lab., Univ. of Michigan, Ann Arbor, MI

10:20 AM

WE2B-1: Chairman's Introduction

R. Caverly

WE2C-1: A High Power and High Efficiency Monolithic Power Amplifier for Local Multiport Distribution Service

M.K. Siddiqui, A.K. Sharma, L.G. Callejo, R. Lai, TRW Space and Electronics Group, Redondo Beach, CA

10:30 AM

WE2A-2: Multi-beam Automotive Radar Front End Using Non-contact Cylindrical NRD Switch

T. Tanizaki, H. Nishida, T. Nishiyama, H. Yamada, K. Sakamoto, Y. Ishikawa, Murata Manufacturing Co. Ltd., Kyoto, Japan

10:40 AM

WE2B-2: Is Our Engineering Education System Suitable to Fulfill the Needs of the Wireless Industry?

L. Besser, Besser Associates, Los Altos, CA

WE2C-2: Ka-band 2 Watt Power SSPA for LMDS Application

J. Shu, T. Hwang, D. Nguyen, R. Pumares, P. Chye, P. Khanna, Hewlett-Packard, Wireless Infrastructure Div., Santa Clara, CA

10:50 AM

WE2A-3: A Flip-chip MMIC Design with CPW Technology in the W-band

T. Hirose, K. Makiyama, T. Shimura, S. Aoki, Y. Ohashi, Y. Watanabe, Fujitsu Labs Ltd., S. Yokohawa, Fujitsu Quantum Devices Ltd., Atsugi, Japan

11:00 AM

WE2A-4: 80 GHz Distributed Amplifiers with Transferred-substrate Heterojunction Bipolar Transistors

B. Agarwal, R. Pulella, Q. Lee, D. Mensa, J. Guthrie, M.J.W. Rodwell, Dept. of Elect. and Comp. Engr., Univ. of California, Santa Barbara, CA

11:10 AM

WE2B-3: East-West Summer Schools in Microwave and Optical Engineering

H.L. Hartnagel, Inst. für Hochfrequenztechnik, TU Darmstadt, Darmstadt, Germany

WE2C-3: High-efficiency, Packaged Ka-band MMIC Operating at 24 Volts

J.M. Schellenberg, Schellenberg Associates, Huntington Beach, CA

11:20 AM

WE2A-5: Characterization of a mm-wave Tapered Slot Antenna with Corrugation Structure

S. Sugawara, Y. Maita, K. Adachi, K. Mori, Gen. Elect. R&D Center, RICOH Co. Ltd., Natori, Japan; K. Mizuno, Tohoku Univ., Sendai, Japan, Inst. of Physical and Chemical Research, Sendai, Japan

11:30 AM

WE2A-6: Optimization of mm-wave Distribution Networks Using Silicon-based CPW

T. Weller, Dept. of Elect. Engr., Univ. of South Florida, Tampa, FL; R. Henderson, S. Robertson, L.P.B. Katehi, EECS Dept., Univ. of Michigan, Ann Arbor, MI

11:40 AM

WE2B-5: A Virtual Field-based Laboratory for Microwave Education

M. Righi, W.J.R. Hoefer, Dept. of Elect. and Comp. Engr., Univ. of Victoria, Victoria, BC, Canada; T. Weiland, Dept. of Elect. Engr. and Info. Tech., Darmstadt Univ. of Tech., Darmstadt, Germany

WE2C-6: A 10 MHz HBT DC-DC Converter for Microwave Power Amplifier Efficiency Improvement

G. Hanington, P.F. Chen, P.M. Asbeck, Univ. of California-San Diego, La Jolla, CA; V. Radisic, T. Itoh, Univ. of California-Los Angeles, CA

11:50 AM

WE2B-7: Educating Tomorrow's RF/Microwave Engineer: A New Undergraduate Laboratory Uniting Circuit and System Concepts

T. Weller, P. Flikkema, L. Dunleavy, H. Gordon, R. Henning, Dept. of Elect. Engr., Univ. of South Florida, Tampa, FL

WE2D Nonlinear Device Modeling

*Chair: C.M. Snowden,
University of Leeds*

ROOM 318/323

WE2E Ferrite Devices:

UHF to W-band
*Chair: L.E. Davis,
UMIST*

ROOM 327/329

10:10 AM

WE2D-1: Analytical Charge Conservative Large Signal Model for MODFETs Validated up to mm-wave Range
R. Osorio, W. Marsetz, L. Verwey, M. Demmler, H. Massler, M. Neumann, M. Schlechtweg, Fraunhofer Inst. for Applied Solid State Physics, Freiburg, Germany; M. Berroth, Inst für Elektrische und Optische Nachrichtentechnik, Stuttgart, Germany

10:20 AM

WE2E-1: Ferrite and Wire Baluns with under 1 dB Loss to 2.5 GHz
A. Riddle, Macallan Consulting, Milpitas, CA

10:30 AM

WE2D-2: Measurement Based Nonlinear Electrothermal Modeling of GaAs FET with Dynamical Trapping Effects
Z. Ouarch, J.P. Teyssier, R. Quere, ICOM CNRS, Univ. Limoges, Limoges, France; J.M. Collantes, Elect. and Electronics Dept. Univ. of Pais Vasco, Bilbao, Spain

WE2E-2: Insertion Loss Analysis of Small Isolator for Portable Phones
S. Takeda, Hitachi Metals Ltd., Tokyo, Japan

10:40 AM

WE2E-3: Thermostable Stripline Lumped Element Circulator for UHF Applications
A.G. Schuchinsky, Deltec New Zealand Ltd., Wellington, New Zealand

10:50 AM

WE2D-3: Modeling of Current Lag Effects in GaAs ICs
W.R. Curtice, W.R. Curtice Consulting, Princeton Junction, NJ; J.H. Bennett, D. Suda, Northern Telecom, Ottawa, Ontario, Canada; B.A. Syrett, Carleton Univ., Ottawa, Ontario, Canada

11:00 AM

WE2D-4: A Physically-based Transient SPICE Model for GaAs MESFETs
R.E. Leoni III, J.W. Bao, M.S. Shirokov, J.C.M. Hwang, Lehigh Univ., Bethlehem, PA

WE2E-4: Finite-difference Time-domain Analysis of a Stripline Disc Junction Circulator
B.S. Yildirim, E.-B. El Sharaway, Dept. of Elect. Engr., Arizona State Univ., Tempe, AZ

11:10 AM

WE2D-5: Characterization and Modeling of Thermal Dynamic Behavior of AlGaAs/GaAs HBTs
K. Lu, X. Zhang, Corp. R&D, M/A-COM Inc., Lowell, MA

11:15 AM

WE2E-5: FDTD Analysis of Microwave Circulators Involving Saturated Magnetized Ferrites
J. Lenge, A. Ahland, J. Kastner, D. Schulz, Lehrstuhl für Hochfrequenztechnik, Univ. Dortmund, Dortmund, Germany

11:20 AM

WE2E-6: The New Approach to Designing W-band Y-junction Circulator with Small Insertion Loss
H.D. Kim, I. Kirsanov, N. Volobouev, RF and Microwave Products Head Office, KMW Inc., Kyungki-Do, Korea

11:30 AM

11:40 AM

WE3A New Guided-wave Effects

Chair: A.A. Oliner,
Polytechnic University
Co-chair: A. Omar,

Technical University of Hamburg
Room 307/308

WE3B Low Noise Techniques

Chair: J.J. Whelehan,
JJW Consulting Inc.

Room 309/310

WE3C High Power, Low Distortion Amplifiers

Chair: A. Platzker, Raytheon Co.
Co-chair: E.J. Crescenzi,
Spectrian Corp.
Room 314/317

1:20 PM

WE3A-1: Space-wave-type Leaky Mode Carrying Dominant-mode-like Current Distributions
C.-K.C. Tzuang, C.-C. Lin, Inst. of Elect. Comm. Engr., Nat. Chiao Tung Univ., Hsinchu, Taiwan

WE3B-1: Characteristics of Broadband InP mm-wave Amplifiers for Radiometry
E.J. Wollack, M.W. Pospieszalski, NRAO, Charlottesville, VA

WE3C-1: Three-dimensional MMIC Architecture Using Low Thermal Impedance Technology
D. Hill, M. Tutt, R. Yarborough, T. Budka, Raytheon TI Systems, Dallas, TX; T. Kim, Texas Instruments Inc., Dallas, TX

1:40 PM

WE3A-2: Unexpected Contribution of Nonphysical Mode to the Fields Excited by a Practical Source in Printed-circuit Transmission Lines
M. Tsuji, H. Takayama, H. Shigesawa, Dept. of Electronics, Doshisha University, Kyoto, Japan

WE3B-2: Noise Temperature Estimates for a Next Generation Very Large Microwave Array
S. Weinreb, Dept. of Physics and Astronomy, UMASS, Amherst, MA

WE3C-2: L-band 100-Watt Push Pull GaAs Power FET
K. Ebihara, H. Takahashi, Y. Tateno, T. Igarashi, Fujitsu Quantum Device Ltd., Yamanashi-Ken, Japan

1:50 PM

WE3B-3: A Comparison of Topologies for Single-ended mm-wave Monolithic Amplifier Design
S. Nam, I.D. Robertson, Dept. of Electronics Engr., King's College, London, UK; S. Miya, M. Ozaki, Asahi Chemical Industry Co. Ltd., Shizuoka, Japan

WE3C-3: 120 Watt, 2 GHz Si LDMOS RF Power Transistor for PCS Base Station Applications
A. Wood, W. Brakensiek, Wireless Infrastructure Sys. Div., Motorola Inc., Phoenix, AZ; C. Dragon, W. Burger, Semiconductor Product Sector, Motorola Inc., Chandler, AZ

2:00 PM

WE3A-3: Mode-coupling Phenomena of the Even Modes on Microstrip Line
J.-W. Sheen, T.-L. Chen, Y.-D. Lin, Inst. of Comm. Engr., Nat. Chiao Tung Univ., Hsinchu, Taiwan, R.O.C.

WE3C-4: High-efficiency L- and S-band Power Amplifiers with High-breakdown GaAs-based PHEMTs
J.A. Puzl, R.D. Widman, N. Kaur, M. BeZaire, Hughes Space and Comm. Co., Los Angeles, CA; J.J. Brown, M. Hu, L.D. Nguyen, Hughes Research Labs., Malibu, CA

2:10 PM

WE3A-4: Propagation and Radiation Characteristics of Gyrotropic Open Structures in the Presence of Sources
P. Baccarelli, C. Di Nallo, F. Frezza, A. Galli, P. Lampariello, Dept. of Electronic Engr., "La Sapienza" Univ. of Rome, Rome, Italy

WE3B-4: Low Noise Broadband MMIC Amplifier Concept
Z. Nosal, Inst. of Electronics Fund., Warsaw Univ. of Technology, Warsaw, Poland

2:20 PM

WE3B-5: A Compact Coplanar W-band Variable Gain Amplifier MMIC with Wide Control Range Using Dual-gate HEMTs
A. Tessmann, W.H. Haydl, T. Krems, M. Neumann, L. Verwey, H. Massler, A. Hulsmann, Fraunhofer Inst. for Applied Solid State Physics, Freiburg, Germany

WE3C-5: Low Distortion and High Efficiency 17 W Power GaAs FETs for Satellite Communication System Applications
H. Tsutsui, I. Takenaka, H. Takasashi, K. Asano, J. Morikawa, K. Ishikura, M. Kuzuhara, ULSI Device Development Labs., NEC Corp., Shiga, Japan

2:30 PM

WE3A-5: Leaky-wave Characteristics of Trapezoidally Shaped NRD-guide Suitable for Design of Millimeter-wave Antenna
S.J. Xu, X.Y. Zhang, Univ. of Science and Technology of China, P.R. China; K. Wu, Ecole Polytechnique de Montreal, Montreal, Canada; K.M. Luk, City Univ. of Hong Kong, P.R. China

WE3B-6: 800 MHz-band Low Noise Low Distortion Si-MMIC Front-end Using BJT/MOSFET LNA and MOSFET Mixer
N. Suematsu, M. Ono, S. Sugiyama, Y. Iyama, O. Ishida, Info. Technology R&D Center, Mitsubishi Electric Corp., Kanagawa, Japan; S. Kubo, ULSI Lab; M. Uesugi, Comm. Eqpt. Works; K. Hasegawa, Sys. LSI Div.; K. Hiroshige, Comm. Sys. Bus. Div., Mitsubishi Electric Corp.

WE3C-6: An L-band Adaptive Digital Predistorter for Power Amplifiers Using Direct I-Q Modem
E.G. Jeckeln, F.M. Ghannouchi, M. Sawan, Dept. of Elect. and Comp. Engr., Ecole Polytechnique de Montreal, Montreal, PQ, Canada

2:40 PM

WE3A-6: Eliminating Surface Waves with Metalodielectric Photonic Crystals
D. Stevenpiper, E. Yablonovich, Dept. of Elect. Engr., Univ. of California, Los Angeles, CA

WE3C-7: A Novel Envelope-termination Load-pull Method for ACPR Optimization of RF/Microwave Power Amplifiers
J.F. Sevic, QUALCOMM Inc., San Diego, CA, (now with Spectrian Corp., Sunnyvale, CA); K.L. Burger, QUALCOMM Inc., San Diego, CA; M.B. Steer, North Carolina State Univ., Raleigh, NC

2:50 PM

WE3B-7: Microwave Low-noise GaAs HBTs
H. Dodo, Y. Amamiya, T. Niwa, M. Mamada, S. Tanaka, H. Shimawaki, Optoelectronics & High Frequency Dev. Res. Lab., NEC Corp., Ibaraki, Japan

WE3D Spectral Regrowth and Distortion of Modulated Signals

Chair: S. Maas,
Nonlinear Technologies Inc.

ROOM 318/323

WE3E Biological Effects and Medical Applications

Chair: A. Rosen,
Sarnoff Corp.

ROOM 327/329

1:20 PM	WE3D-1: <i>Simulation of Multi-tone IMD Distortion and Spectral Regrowth Using Spectral Balance</i> N.B. de Carvalho, J.C. Pedro, Univ. de Aveiro, Aveiro, Portugal	WE3E-1: <i>A 9.2 GHz Microwave Applicator for the Treatment of Menorrhagia</i> I. Feldberg, Microsulis Ltd., Waterlooville, UK; N.J. Cronin, School of Physics, Bath Univ., Bath, UK
1:40 PM	WE3D-2: <i>A Nonlinear ARMA Model for Simulating Power Amplifiers</i> G. Chrisikos, C.J. Clark, A.A. Moulthrop, M.S. Muha, C.P. Silva, The Aerospace Corp., El Segundo, CA	WE3E-2: <i>Study on Diagnosis for Tooth Using Millimeter Waves</i> N. Hoshi, Y. Nikawa, School of Elect. Engr., Nat. Defense Academy, Yokosuka, Japan; K. Kawai, S. Ebisu, Dept. of Conservative Dent., Osaka Univ., Osaka, Japan
1:50 PM	WE3D-3: <i>Residual Second Order Intermodulation Suppression in Third Order Distortion Generators</i> W. Huang, R.E. Saad, Harmonic Lightwaves Inc., Sunnyvale, CA	
2:00 PM	WE3D-4: <i>Efficient Simulation of NPR for the Optimum Design of Satellite Transponders SSPAs</i> J. Lajoine, E. Ngoya, D. Barataud, J.M. Nebus, IRCOM-UMR CNRS, Univ. of Limoges, Limoges, France; J. Sombrin, CNES, Toulouse, France; B. Rivierre, ALCATEL-ESPACE, Toulouse, France	WE3E-3: <i>Microwave Systems for Tomography and Spectroscopy of Biological Objects</i> S.Y. Semenov, R.H. Svenson, A.V. Pavlosky, A.E. Souvorov, A.E. Bulyshev, G.P. Tatis, Carolinas Medical Center, Charlotte, NC; Y.E. Sizov, A.G. Nazarov, Kurchatov Inst., Moscow, Russia
2:10 PM		
2:20 PM	WE3D-5: <i>Validation of a New Nonlinear HEMT Model by Intermodulation Characterization</i> G. Qu, A. Parker, Electronics Dept., Macquarie Univ., Sydney, Australia	WE3E-4: <i>Accuracy Study of FDTD Calculations of a Dipole Antenna Irradiating a Lossy Sphere</i> W. Heyvaert, N. Ilijasevic, L. Martens, Dept. of Info. Tech. (INTEC), Univ. of Gent, Gent, Belgium
2:30 PM	WE3D-6: <i>Improved Prediction of the Intermodulation Distortion Characteristics of MESFETs and PHEMTs Via a Robust Nonlinear Device Model</i> V.I. Cojocaru, T.J. Brazil, Dept. of Electronic and Elect. Engr., Univ. College, Dublin, Ireland	
2:40 PM		WE3E-5: <i>Cellular Phones Effects on Autoacoustic Emissions</i> G. Grisanti, C. Tamburello, G. Tine, Univ. of Palermo, Palermo, Italy; C. Parlapiano, Inst. della Biocomunicazione, Cattedra di Audiologia, Italy; L. Zanforlin, Dip. Ingegneria Elettrica, Univ. of Palermo, Palermo, Italy
2:50 PM		

WE4A Properties of Substrates and Artificial Surfaces

Chair: M. Dydyk, Motorola G.S.T.G.
Co-chair: S. El-Ghazaly,
Arizona State University
 ROOM 307/308

WE4B Packaging and Interconnects

Chair: R. Sturdivant,
Raytheon SCS
Co-chair: J. Wooldridge, TRW

ROOM 309/310

WE4C HF/VHF/UHF Power Amplifiers

Focused Session
Chair: F.H. Raab,
Green Mountain Radio Research

ROOM 314/317

3:30 PM

WE4A-1: *Finite Element Method for Rigorous Design of Microwave Devices Using Photonic Bandgap Structures*
 B. Lenoir, D. Baillargeat, S. Verdeyme, P. Guillon, I.R.C.O.M.-UMR CNRS, Limoges, France

WE4B-1: *Millimeterwave Characteristics of Flip-chip Interconnects for Multi-chip Modules*
 W. Heinrich, A. Jentzsch, Ferdinand-Braun Institut, Berlin, Germany; G. Baunmann, Alcatel SEL AG, Pforzheim, Germany

WE4C-1: *Class E High-efficiency Power Amplifiers from HF to Microwave*
 N.O. Sokal, Design Automation Inc., Lexington, MA

3:50 PM

WE4A-2: *Microwave Properties of Coplanar Transmission Lines and Filters on Diamond from 1-120 GHz*
 F. Steinhagen, W.H. Haydl, T. Krems, R. Locher, C. Wild, P. Koidl, A. Hulsman, Fraunhofer Inst. for Appl. Solid State Physics (IAF), Freiburg, Germany

WE4B-2: *Development of a Package Utilizing an Electromagnetic Coupling Structure*
 M. Fujii, S.-I. Koriyama, K. Kitazawa, R&D Center, Kyocera Corp., Kyoto, Japan

WE4C-2: *A Low Cost Class-E Power Amplifier with Sine-wave Drive*
 J.F. Davis, D.B. Rutledge, Dept. of Elect. Engr., California Inst. of Technology, Pasadena, CA

4:00 PM

WE4B-3: *Avoiding Cross Talk and Feedback Effects in Packaging Coplanar mm-wave Circuits*
 T. Krems, A. Tessmann, W.H. Haydl, Fraunhofer Inst. for Applied Solid State Physics IAF, Freiburg, Germany

4:10 PM

WE4A-3: *Theoretical and Experimental Investigation of Bias and Temperature Effects on High Resistivity Silicon Substrates for RF Applications*
 A.C. Reyes, W.S.S.G., S.P.S., Motorola Inc., Tempe, AZ; S.M. El-Ghazaly, Dept. of Elect. Engr., Arizona State Univ., Tempe, AZ; M. Dydyk, G.S.T.G., Motorola Inc., Scottsdale, AZ

WE4C-3: *Capabilities of Low-cost High Voltage RF Power MOSFETs at HF and VHF*
 R. Frey, Advanced Power Technology Inc., Bend, OR

4:20 PM

WE4B-4: *RF Performance of a 77 GHz Monolithic CPW Amplifier with Flip-chip Interconnections*
 K. Marchashi, M. Itoh, K. Ohta, Kansai Elect. Research Lab., NEC Corp., Shiga, Japan; H. Kusamitsu, Y. Morishita, Prod. Mat. Engr. Lab., NEC Corp., Kanagawa, Japan

4:30 PM

WE4A-4: *Near and Far Field Characterization of Radiation from Ultra-fast Electronic Systems*
 K.A. Remley, A. Weisshaar, V.K. Tripathi, Dept. of Elect. and Comp. Engr., Oregon State Univ., Corvallis, OR; S.M. Goodnick, Dept. of Elect. Engr., Arizona State Univ., Tempe, AZ

WE4C-4: *A Novel High Frequency Single Sideband Transmitter*
 R.L. Campbell, TriQuint Semiconductor, Hillsboro, OR

4:40 PM

WE4B-5: *The Thermal Benefits of Diamond Enhanced Packages for Microwave Applications*
 M. Gomes-Cesseres, Sanders, A Lockheed-Martin Co., Nashua, NH

4:50 PM

WE4A-5: *Edge Element Modeling of 3D Interconnection Structures*
 J. Tan, Compact Software Inc.; G. Pan, Arizona State Univ., B.K. Gilbert, Mayo Foundation

WE4C-5: *Ultra Linear/Feedforward Amplifier Design*
 D. Myer, Communication Power Corp., Brentwood, NY

5:00 PM

WE4B-6: *Development of mm-wave Multi-layer Organic Based MCM Technology*
 A. Pham, A. Sutono, J. Laskar, Sch. of Elect. and Comp. Engr., Georgia Institute of Technology, Atlanta, GA; V. Krishnamurthy, H.S. Cole, T. Sitnik-Nieters, GE Corp. R&D Center, Schenectady, NY

**WE4D Nonlinear Modeling
of Circuit-field Interactions**
Chair: M.B. Steer,
North Carolina State University

ROOM 318/323

**WE4E High Power Generation,
Amplification and Control Components**
Chair: J. Goel, TRW, S&EG

ROOM 327/329

3:30 PM

**WE4D-1: Harmonic Balance Analysis for Systems
with Circuit-field Interactions**
C.E. Christofferson, M.B. Steer, M.A. Summers, Dept.
of Elect. and Comp. Engr., North Carolina State Univ.,
Raleigh, NC

3:50 PM

**WE4D-2: Global Time-domain Full-wave Analysis
of Microwave FET Oscillators and Self-oscillating Mixers**
M. Chen, W.R. Deal, T. Itoh, Dept. of Elect. Engr.,
Univ. of California, Los Angeles, CA; B. Houshmand,
Jet Propulsion Lab., Pasadena, CA

4:00 PM

WE4D-3: RF Power Detector Using Silicon MOSFET
M. Ratni, B. Huyart, E. Bergeault, L. Jallet, ENST,
Paris, France

4:10 PM

**WE4E-1: Adaptive Joint Linearization/Equalization
with Delay Alignments for a Wide-band Power Amplifier**
J.-T. Chen, Dept. of Elect. Engr., Stanford Univ.,
Stanford, CA; H.-S. Tsai, Y.-K. Chen, Bell Labs,
Lucent Tech., Murray Hill, NJ

**WE4E-2: An X-band 2 kW CW GaAs FET Power
Amplifier for Continuous Wave Illuminator Application**
H. Ashoka, J. Ness, A. Robinson, M. Gourlay, J. Logan,
P. Woodhead, D. Reuther, MITEC Ltd.,
Brisbane, Australia

4:20 PM

**WE4E-3: The Design and Analysis of Multi-megawatt
Distributed Single Pole Double Throw (SPDT)
Microwave Switches**
S.G. Tantawi, M.I. Patelin, Stanford Linear Accelerator
Center, Stanford Univ., Stanford, CA

4:30 PM

**WE4E-4: Use of a Magnetron as a High-gain, Phase-
locked Amplifier in an Electronically-steerable
Phased-array
for Wireless Power Transmission**
M.C. Hatfield, J.G. Hawkins, Univ. of Alaska,
Fairbanks, AK; W.C. Brown, Microwave Power Trans.
Systems, Weston, MA

4:40 PM

4:50 PM

**WE4E-5: A Novel Oscillating Rectenna
for Wireless Microwave Power Transmission**
J.O. McSpadden, L. Fan, K. Chang, Dept. of Elect.
Engr., Texas A&M Univ., College Station, TX;
R.M. Dickinson, Jet Propulsion Lab., Pasadena, CA

5:00 PM

WEDNESDAY

WEIF-01: *A New Design Procedure for Single-layer and Two-layer 3-line Baluns*
C. Cho, K.C. Gupta, Dept. of Elect. and Comp. Engr., Univ. of Colorado at Boulder, Boulder, CO

WEIF-02: *Three-Port 3-dB Power Divider Terminated by Arbitrary Impedances*
H.-R. Ahn, I. Wolff, Gerhard-Mercator Univ. Duisburg, Duisburg, Germany

WEIF-03: *Wideband, Planar, Log-periodic Balun*
M. Basraoui, S.N. Prasad, Dept. of Elect. and Comp. Engr., Bradley Univ., Peoria, IL

WEIF-04: *Planar Transmission Line Transformer Using Coupled Microstrip Lines*
S.-P. Liu, Comp. and Comm. Research Labs, Ind. Technology Research Inst., Hsinchu, Taiwan

WEIF-05: *High Q On-chip Passive Components for UTSi CMOS Technology*
M. Magahed, R. Benton, L. Lo, J. Canyon, M. Burgener, M. Stuber, X. Wu, Peregrine Semiconductor Corp., San Diego, CA

WEIF-06: *Resonant Coupling Type Microstrip Line Interconnect Using a Bonding Ribbon and Dielectric Pad*
M. Hotta, Dept. of Elect. Engr., Ehime Univ.; Y. Qian, T. Itoh, Elect. Engr. Dept., Univ. of California at Los Angeles, CA

WEIF-07: *Design of Planar, Single-layer Microwave Baluns*
D. Raicu, California Eastern Labs, Santa Clara, CA

WEIF-08: *A New Enhanced Coupling Structure of Ring Resonator with Two Coupled Lines and a Slit*
J.-Y. Park, J.-C. Lee, Dept. of Radio Science and Engr., Kwangwoon Univ., Seoul, Korea

WEIF-09: *Simultaneous Realization of Millimeter Wave Uniplanar Shunt Stubs and DC Block*
K. Hettak, G. Delisle, M. Boulmalf, INRS-Telecommunications, Ile des Soeurs, PQ, Canada

WEIF-10: *Accurate CAD of Integrated Band-pass and Second Harmonic Band-reject Microwave Filters*
M. Guglielmi, European Space Research and Technology Centre, Noordwijk, The Netherlands; P. Bertalan, A. Nguyen, TRT Lucent Technologies, Le Plessis Robinson, France

WEIF-11: *Modeling of Coupling between Double Ridge Waveguide and Dielectric Loaded Resonator*
C. Wang (now with CELWAVE, Marlboro, NJ), K.A. Zaki, Elect. Engr. Dept., Univ. of Maryland, College Park, MD,

WEIF-12: *Synthesis of General Topology Multiple Coupled Resonator Filters by Optimization*
W.A. Atia, K.A. Zaki, Elect. Engr. Dept., Univ. of Maryland, College Park, MD; A.E. Atia, Orbital Sciences Corp., Germantown, MD

WEIF-13: *High Q TE₀₁ Mode DR Cavity Filters for PCS Wireless Base Stations*
J.-F. Liang, Conductus Inc., Sunnyvale, CA; W.D. Blair, Celwave, Marlboro, NJ

WEIF-14: *A Miniaturized End-coupled Bandpass Filter Using Lambda/4 Hair-pin Coplanar Resonators*
T. Tsujiguchi, H. Matsumoto, T. Nishikawa, Murata Manufacturing Co., Ltd., Ishikawa, Japan

WEIF-15: *FDTD Calculation of Coupling Coefficient between Two Resonators*
I. Awai, Y. Oda, Yamaguchi Univ., Yamaguchi, Japan

WEIF-16: *Distributed Coupling in a Circular Dielectric Disk Resonator and Its Application to a Square Dielectric Disk Resonator to Fabricate a Low-profile Dual-mode BPF*
A.C. Kundu, I. Awai, Faculty of Engr., Yamaguchi Univ., Ube, Japan

WEIF-17: *Nonlinear Behavior of Electromagnetic Waves in the YIG Film Microstrip Line*
M. Tsutsumi, T. Ueda, Kyoto Inst. of Technology, Kyoto, Japan; K. Okubo, Okayama Prefectural Univ., Okayama, Japan

WEIF-18: *Low TB Radio SAW Sensors Incorporating Chirped Transducers and Reflectors for Wireless Pressure Sensing Applications*
T. Pankratz, R. Weigel, Univ. of Linz, Linz, Austria; H. Scherr, L. Reindl, C.C.W. Ruppel, Siemens AG, Munich, Germany

WEIF-19: *Understanding and Modeling the Non-monotonic Attenuation Behavior of PIN Limiter Diodes*
R.H. Caverly, Dept. of Elect. and Comp. Engr., Villanova Univ., Villanova, PA; G. Hiller, Alpha Industries, Woburn, MA

WEIF-20: *New Compact Double Balanced Monolithic Down-converter Application to a Single Chip MMIC Receiver for Satellite Equipment*
J.F. Villemazet, J. Dubouloy, M. Souldard, Alcatel ESPACE/LEMMIC, Nanterre, France; J.C. Cayrou, E. Husse, B. Cogo, J.L. Cazaux, Alcatel ESPACE, Toulouse, France

WEIF-21: *Unbalance Effects of an Antiparallel Diode Pair on the Virtual Local Leakage in an Even Harmonic Mixer*
K. Itoh, Mitsubishi Electric Corp., Amagasaki City, Japan; K. Kawakami, O. Ishida, R&D Center, Mitsubishi; K. Mizuno, Tohoku University

WEIF-22: *A K-Band DRO in Coplanar Layout with Dry- and Wet-Etched InP HEMTs*
H.C. Duran, U. Lott, H. Benedickto, W. Baechtold, Lab. for Electromagnetic Fields and Microwave Elect., Swiss Fed. Inst. of Tech., Zurich, Switzerland

WEIF-23: *Distributed Oscillator at 4 GHz*
L. Divina, Z. Skvor, Dept. of Electromagnetic Field, Czech Technical Univ. of Prague, Prague, Czech Republic

WEIF-24: *Broadband Monolithic Analog Phase Shifter and Gain Circuit for Frequency Tunable Microwave Active Filters*
A. Cenac, L. Nenert, L. Billonnet, B. Jarry, P. Gillon, I.R.C.O.M.-UMR CNRS, Limoges, France

WEIF-25: *A Stability-ensuring Procedure for Designing High Conversion-gain Frequency Doublers*
I. Schmale, G. Kompa, Univ. of Kassel, Kassel, Germany

WEIF-26: *mm-wave Monolithic Balanced BPSK Modulator Using a Miniaturised Backward-wave Coupler*
T. Gokdemir, S. Nam, A.E. Ashtiani, I.D. Robertson, Dept. of Electronic and Elect. Engr., King's College, London, UK

WEIF-27: *FDTD Analysis of a Quasi-planar mm-wave Frequency Doubler*
W. Thiel, W. Menzel, Univ. of Ulm, Ulm, Germany

WEIF-28: *A Modified Matrix Pencil Moment Method for Multimode Waveguide Discontinuities Analysis*
L. Kadri, P.H. Pannier, S. Seguinot, P. Kennis, F. Huret, U.M.R. C.N.R.S., Univ. de Villeneuve d'Ascq, Villeneuve d'Ascq, France

WEIF-29: A Simple Method to Correct the Reflection Error of Absorbing Boundary Condition in FDTD Analysis of Waveguides

Z. Lin, K. Naishadham, Dept. of Elect. Engr.,
Wright State Univ., Dayton, OH

WEIF-30: Finite Difference Quasi-TEM Mode Analysis of Coupled Coplanar Lines Used in (M)MIC Directional Couplers

M. Naghed, B. Hopf, I. Wolff, IMST, Inst. of Mobile
and Satellite Comm. Tech., Kamp-Lintfort, Germany

WEIF-31: Designing Single-mode VCSEL Using an Extended Finite-difference Time-domain Technique

W. Sui, Bell Labs, Lucent Technologies, Murray Hill, NJ;
D.A. Christensen, G. Gray, C.H. Durney, Elect. Engr.
Dept., Univ. of Utah, Salt Lake City, UT

WEIF-32: Modification of the 3D-TLM Scattering Matrix to Model Nonlinear Devices in Graded and Heterogeneous Regions

L. Cascio, W.J.R. Hoefer, Dept. of Elect. and Comp. Engr.,
Univ. of Victoria, Victoria, BC, Canada

WEIF-33: Simple Equivalent Circuit Modeling of Small Apertures in Transmission Line Matrix (TLM) Method

G. Tardioli, W.J.R. Hoefer, Dept. of Elect. and Comp.
Engr., Univ. of Victoria, Victoria, BC, Canada

WEIF-34: Comparison between FDTD Graded Grids

R.C. Tupyamba, A.S. Omar, Arbeitsbereich
Hochfrequenztechnik, TU Hamburg-Harburg,
Hamburg, Germany

WEIF-35: The Design of Parallel-coupled-line Filter with Arbitrary Image Impedance

D. Ahn, C.-S. Kim, M.-H. Chung, D.-H. Lee, D.-W. Lew,
Dept. of Electronics, Soonchunhyang Univ., Chungnan,
R.O. Korea; H.-J. Hong, Elect. and Telecomm. Research
Inst., R.O. Korea

WEIF-36: Analysis of Waveguide E-plane Discontinuities and Components Based on Planar-circuit Approach

M. Kishihara, T. Kawai, Y. Kokubo, I. Ohta,
Dept. of Electronics, Himeji Inst. of Technology,
Hyogo, Japan

WEIF-37: Waveguide Step Discontinuities Revisited by the Generalized Network Formulation

M. Mongiardo, M. Dionigi, Inst. of Electronics,
Univ. of Perugia, Perugia, Italy; P. Russer, TU Munich,
Munich, Germany; L.B. Felsen, Boston Univ., Boston, MA

WEIF-38: Fast and Rigorous CAD of Phase Delay Equalizers by Mode Matching Techniques Including Losses

R. Keller, W. Hauth, F.-J. Goertz, Bosch Telecom,
Backnang, Germany; F. Arndt, T. Sieverding, U. Papziner,
Inst. for High-Frequency Tech., Univ. of Bremen,
Bremen, Germany

WEIF-39: Analysis of 3-D Cylindrical Structures Using the Finite Difference Time Domain Method

N. Dib, EE Dept., Jordan Univ. of Science and
Technology, Irbid, Jordan; T. Weller, M. Scardelletti, EE
Dept., Univ. of South Florida, Tampa, FL

WEIF-40: Arbitrarily Oriented Perfectly Matched Layer in Frequency Domain

E.X. Xu, R. Sloan, Dept. of Elect. Engr. and Electronics,
Univ. of Manchester, Inst. of Science and Technology,
Manchester, UK

WEIF-41: Accurate Broadband Characterization of Transmission Lines

Y.C. Shih, MMCOMM Inc., Torrance, CA; K.S. Kong,
Hughes Aircraft Co., Torrance, CA

WEIF-42: A Frequency/Time Domain Characterization Technique for Frequency-translating Devices

N. Boulefflen, F.M. Ghannouchi, A.B. Kouki, Ecole
Polytechnique de Montreal, Montreal, PQ, Canada

WEIF-43: Modeling of Correlated Noise in RF Bipolar Devices

S. Martin, M. Frei, K. Ng, Bell Labs, Lucent Technologies,
Murray Hill, NJ, R. Booth, P. Subramanian (Cedar Crest),
Y.-F. Chyan, K.H. Lee (Orlando), D. Goldthorp,
S. Moinian (Reading)

WEIF-44: A New Time-domain Measurement Technique for Microwave Devices

A.A. Moulthrop, M.S. Muha, C.P. Silva, C.J. Clark,
The Aerospace Corp., El Segundo, CA

WEIF-45: High Resolution Electro-optic Mapping of Near-field Distributions in Integrated Microwave Circuits

K. Yang, G. David, S. Robinson, J.F. Whitaker, L. Katehi,
Dept. of Elect. Engr. and Comp. Science,
Univ. of Michigan, Ann Arbor, MI

WEIF-46: A Novel Vector Network Analyzer

K. Hoffmann, Z. Skvor, Dept. of Electromagnetic Field,
Czech Technical Univ., Prague, Czech Republic

WEIF-47: Membrane Probe Technology for Non-destructive Thin-film Material Characterization

A. Pham, J. Laskar, School of Elect. and Comp. Engr.,
Georgia Inst. of Technology, Atlanta, GA; L. Hayden,
Cascade Microtech, Inc., Beaverton, OR

WEIF-48: In-situ Microwave Characterization of Insulator Thin Films for Interconnects of Advanced Circuits

B. Flechet, C. Bermond, P. Ferrari, G. Angenieux, Lab.
d'Hyperfréquences et de Caractérisation (LAHC), Univ. de
Savoie, Le Bourget du Lac, France

WEIF-49: Near-field Scanning Microwave Microscopy of Room Temperature and Superconducting Microwave Devices

S.M. Anlage, D.E. Steinhauer, C.P. Vlahacos, S. Dutta,
A. Thanawalla, B.J. Feenstra, F.C. Wellstood,
Dept. of Physics, Univ. of Maryland, College Park, MD

WEIF-50: Calibration of Short Range FMCW-Radars with Network Analyzer Calibration Techniques

T. Hauschild, R. Knoechel, Technische Fakultät der
Christian Albrechts Univ. zu Kiel, Kiel, Germany

WEIF-51: Effect of Demodulator Errors on Predistortion Linearization

Q. Ren, I. Wolff, Dept. of Elect. Engr., Gerhard-Mercator
Univ. Duisburg, Duisburg, Germany

WEIF-52: Self-tracking Duplex Communications Link Using Integrated Retrodirective Antennas

S.L. Karode, V.F. Fusco, Dept. of Elect. and Electronic
Engr., The Queen's Univ. of Belfast, Belfast,
N. Ireland, UK

WEIF-53: Low Cost UTSi Technology for RF Wireless Applications

M. Megahed, M. Burgener, J. Cable, R. Benton, D. Staab,
M. Stuber, P. Dennies, R. Reedy, Peregrine Semiconductor
Corp., San Diego, CA

WEIF-54: Ferroelectric Films: Nonlinear Properties and Applications in Microwave Devices

A. Kozyrev, A. Ivanov, V. Keis, M. Khazov, V. Osadchy,
T. Samoilova, O. Soldatenkov, St. Petersburg Electrotech.
Univ., St. Petersburg, Russia; G. Koepf, C. Muller, D. Galt,
T. Rivkin, Superconducting Core Tech. Inc., Golden, CO

WEIF-55: *A Statistical Relationship for Power Spectral Regrowth in Digital Cellular Radio*
K.G. Gard, QUALCOMM Inc., San Diego, CA;
M.B. Steer, North Carolina State Univ., Raleigh, NC

WEIF-56: *A 94 GHz Aperture-coupled Micromachined Microstrip Antenna*
G.P. Gauthier, L.P. Katehi, G.M. Rebeiz, Elect. Engr. and Comp. Science Dept., Univ. of Michigan, Ann Arbor, MI

WEIF-57: *Novel Active Antenna Amplifying Arrays*
Y.-C. Yang, K. Chang, Dept. of Elect. Engr., Texas A&M Univ., College Station, TX; S.-J. Chung, Dept. of Telecom., Nat. Chao-Tung Univ., Hsinchu, Taiwan

WEIF-58: *Low Profile, 2-D Scanning MMW Antenna Controlled by Two Currents*
E.F. Zaitsev, A.B. Gouskov, Cherepanov-St. Petersburg State Techn. Univ., St. Petersburg, Russia; G.A. Yufit, M.R. Beltran, Y.S. Khodorovsky, Beltran Inc., New York

WEIF-59: *A New Optical-microwave Double Mixing Method*
T. Berceli, G. Jaro, BME-MHT, Technical Univ. of Budapest, Dept. of Microwave Telecom., Budapest, Hungary

WEIF-60: *Self-bias Control of Electroabsorption Waveguide Modulator*
G.L. Li, P.K.L. Yu, Univ. of California, San Diego, CA

WEIF-61: *A Novel K-band Tunable Microstrip Bandpass Filter Using a Thin Film HTS/Ferroelectric/Dielectric Multilayer Configuration*
G. Subramanyam, Univ. of Northern Iowa, Cedar Falls, IA; F. Van Keuls, F.A. Miranda, NASA Lewis Research Center, Cleveland, OH

WEIF-62: *A Novel Approach to Modeling the Nonlinear Propagation Characteristics of HTS Planar Transmission Lines*
G.M. Coutts, S.K. Chaudhuri, Univ. of Waterloo, Waterloo, Ontario, Canada; R.R. Mansour, COM DEV, Cambridge, Ontario, Canada

WEIF-63: *A Two-mode Dielectric Rod Resonator Method for Measuring Surface Impedance of High T_c Substrates*
Y. Kobayashi, H. Yoshikawa, Dept. of Elect. and Electronic Engr., Saitama Univ., Saitama, Japan

WEIF-64: *New Classes of Microstrip Resonators for HTS Microwave Filters Applications*
F. Rouchaud, V. Madrangeas, M. Aubourg, P. Guillon, I.R.C.O.M.-UMR CNRS, Limoges, France; B. Theron, M. Maignan, Alcatel ESPACE, Toulouse, France

WEIF-65: *Tunable Superconducting Band-stop Filters*
S. Gevorgian, E. Carlsson, E. Kollberg, E. Wikborg, Dept. of Microwave Technology, Chalmers Univ. of Technology, Gothenburg, Sweden

WEIF-66: *Design of Cryogenic (4.2K) X-band HEMT Oscillator for Josephson Voltage Standard*
M.-Q. Lee, S. Nam, School of Elect. Engr., Seoul National Univ., Seoul, Korea; K.-W. Yeom, Chungnam Nat. Univ.; K.-T. Kim, Korea Research Inst. of Standards and Science

WEIF-67: *Micro-coplanar Striplines – New Transmission Media for Microwave Applications*
K. Goverdhanam, L.P.B. Katehi, Radiation Lab., EECS Dept., Univ. of Michigan, Ann Arbor, MI; R.N. Simons, NASA Lewis Research Center, Cleveland, OH

WEIF-68: *Thin Film Tunnels vs. Air-bridges in Coplanar Waveguide Discontinuities*
E.A. Soliman, P. Pieters, E. Beyne, IMEC, Leuven, Belgium

WEIF-69: *Power-combining Grids for Frequency Tuning and Beam Control Applications*
L.Q. Sun, R.M. Weikle II, Dept. of Elect. Engr., Univ. of Virginia, Charlottesville, VA

WEIF-70: *A Low Cost Active Transceiving Antenna*
A.K.Y. Lai, J.H.H. Ng, Dept. of Elect. Engr., The Chinese Univ. of Hong Kong, Hong Kong, P.R. China

WEIF-71: *A New Mixer for Sensor Applications*
I. Angelov, Chalmers Inst. of Technology, Goteborg Sweden; H. Zirath, Chalmers Inst. of Technology and Eriksson Microwave, Molndal, Sweden; J. Svedin, FOA, Linkoping, Sweden

WEIF-72: *A Direction Sensitive, Integrated, Low Cost Doppler Sensor for Automotive Applications*
R.H. Raschofer, E.M. Biebl, Inst. für Hochfrequenztechnik der Technischen Univ. München, München, Germany

THIF-01: *A Method for Computing Adjacent-channel Spectral Energy in Cellular Power Amplifiers*
S. Pinsky, Triquint Semiconductors, Hillsboro, OR

THIF-02: *Signal and Noise Analysis of Large Microwave Front-ends by the Inexact-Newton Harmonic-balance Technique*
V. Rizzoli, Dept. of Elect. Info. and Systems, Univ. of Bologna, Bologna, Italy; F. Mastro, Dept. of Elect. Engr., Univ. of Bologna, Bologna, Italy; C. Cecchetti, Fondazione Ugo Bordoni, Bologna, Italy

THIF-03: *A Nonlinear Model of the Power MESFET Including Temperature and Breakdown Effects*
V. Rizzoli, A. Costanzo, Univ. of Bologna, Bologna, Italy; C. Cecchetti, Fondazione Ugo Bordoni, Bologna, Italy; A. Chiarini, Fondazione Guglielmo Marconi, Bologna, Italy

THIF-04: *A Simplified Large-signal HBT Model for RF Circuit Design*
K. Lu, X. Zhang, G.N. Henderson, Corp. R&D, M/A-COM Inc., Lowell, MA

THIF-05: *Effect of Input Harmonic Termination on High Efficiency Class-B and Class-F Operation of PHEMT Devices*
P.M. White, Raytheon Electronics, Andover, MA

THIF-06: *Sample-balance Analysis of Nonlinear Autonomous Circuits*
P.J.C. Rodrigues, D. Mendes Jr., Inst. Tecnológico De Aeronautica, CTA-ITA-IEEC, Sao Jose dos Campos, Brazil

THIF-07: *A Novel Distortion Analysis Method for Amplifiers Considering Frequency Characteristics*
K. Horiguchi, K. Yamauchi, K. Morti, M. Nakayama, T. Takagi, Information Technology R&D Center, Mitsubishi Electric Corp., Kanagawa, Japan

THIF-08: *Improvements on a GaAs MESFET Model for Nonlinear RF Simulations*
F. Ellinger, J. Kucera and W. Baechtold, Swiss Fed. Inst. of Technology (ETH) Zurich, Zurich, Switzerland

THIF-09: *A Simple and Systematic Method for the Design of Tapered Nonlinear Transmission Lines*
J. Jrad, P. Ferrari, C. Fuchs, A. Dominjon, J.W. Tao, B. Flechet, G. Angenieux, LAHC, Lab. d'Hyperfrequences et de Caracterisation, Univ. de Savoie, Le Bourget-du-Lac, France

THIF-10: *Improved Analytical Analysis of Noise Figures in HEMT Mixers*
W. Ko, Y. Kwon, School of Elect. Engr., Seoul National Univ., Seoul, Korea

THIF-11: *Characterizing the Gate to Source Nonlinear Capacitor Role on FET IMD Performance*
J.A. Garcia, A. Mediavilla, A. Tazon, J.L. Garcia, Dept. Engr. de Comunicaciones, Univ. de Cantabria, Santander, Spain; J.C. Pedro, N.B. Carvalho, Inst. de Telecom., Univ. de Aveiro, Aveiro, Portugal

THIF-12: *A Fully-distributed Heterostructure-barrier-varactor Nonlinear-transmission-line Frequency Tripler*
M. Li, R.G. Harrison, Dept. of Electronics, Carleton Univ., Ottawa, Ontario, Canada

THIF-13: *Record Power Added Efficiency, Low Voltage GOI (GaAs on Insulator) MESFET Technology for Wireless Applications*
P. Parikh, J. Ibbetson, U. Mishra, ECE Dept., Univ. of California, Santa Barbara, CA; D. Doctor, M. Le, K. Kiziloglu, D. Grider, Hughes Research Labs, Malibu, CA; J. Puhl, Hughes Space and Comm., Los Angeles, CA

THIF-14: *Increased Efficiency in QAM Power Amplifiers*
D.R. Conn, R.H. Hemmers, Dept. of Elect. and Comp. Engr., McMaster Univ., Hamilton, Ontario, Canada

THIF-15: *2.4V Single Supply Pseudomorphic MODFET MMIC Power Amplifier for Digital Cordless Phones*
T. Yokoyama, M. Nishijima, T. Kuniyama, S. Yamamoto, O. Ishikawa, Electronics Res. Lab., Matsushita Electronics Corp., Osaka, Japan

THIF-16: *An Improvement of IM and Power of High Power Amplifiers Using RC-parallel Circuits with Frequency Selectivity*
Y. Tarui, Y. Itoh, Information Technology R&D Center, Mitsubishi Electric Corp, Kanagawa, Japan; S. Ogura, K. Seino, Kamakura Works, Kanagawa, Japan

THIF-17: *1 Watt Compact Ka-band MMIC Power Amplifiers Using Lumped Element Matching Circuits*
M. Komaru, H. Hoshi, H. Kurusu, Y. Notani, T. Katoh, T. Ishida, T. Oku, T. Ishikawa, Y. Mitsui, Optoelectronic and Microwave Devices Lab., Mitsubishi Electric Corp., Hyogo, Japan

THIF-18: *Development of Cryogenic Load-pull Analysis: Power Amplifier Technology Performance Trends*
E. Gebara, J. Laskar, School of Elect. and Comp. Engr., Georgia Inst. of Technology, Atlanta, GA; M. Harris, Georgia Tech Research Inst., Atlanta, GA; T. Kikel, Space and Missile Defense Command, Huntsville, AL

THIF-19: *Improvement of Efficiency and Linearity of a Harmonic Control Amplifier by Envelope Controlled Bias Voltages*
D. Smely, B. Ingruber, M. Wachutka, G. Magerl, Dept. of Comm. and Radio-Freq. Engr., Vienna Univ. of Technology, Vienna, Austria

THIF-20: *X-band InGaP PHEMTs with 70% Power-added Efficiency*
M.-Y. Kao, E.A. Beam III, P. Saunier, Raytheon TI Systems, Dallas, TX; W.R. Frenley, Univ. of Texas at Dallas, Richardson, TX

THIF-21: *Linearization of 1.85 GHz Amplifier Using Feedback Canceling Loop*
Y. Kim, Y.G. Yang, S.H. Kang, B. Kim, Microwave Application Center, Univ. of Pohang Inst. of Science and Technology, Kyungpook, Korea

THIF-22: *High Breakdown Voltage GaAs MESFET for High Reliability and High Efficiency Power Amplifiers*
Y.A. Tkachenko, C.J. Wei, D. Bartle, Alpha Industries Inc., Woburn, MA

THIF-23: *MMIC-compatible Terminal Protection Device*
R. Kaul, Army Research Lab., Adelphi, MD; J. McAdoo, W.M. Bollen, W. Catoe, Mission Research Corp., Newington, VA

THIF-24: Investigation and Application to LNA of an InP-HEMT Operated at Ultra Low DC Power Levels
L. Pattersson, J.P. Starski, H. Zirath, Div. of Microwave Technology, Chalmers Univ. of Technology, Gothenburg, Sweden

THIF-25: Intrinsic Limitations of GaAs Device Cooling for Microwave Low Noise Applications
J.M.M. Pantoja, J.L. Sebastian, S.M.S. Martin, Dept. de Fisica Aplicada III, Univ. Complutense de Madrid, Madrid, Spain

THIF-26: MOTT SiGeSIMMWICs
K.M. Strohm, J.-F. Luy, T. Hachbarth, Daimler Benz Research Center, Ulm, Germany; S. Kossowski, United Monolithic Semiconductors, Ulm, Germany

THIF-27: Low-frequency Noise in GaAs and InP Schottky Diodes
K.F. Sato, C.W. Chan, K. Najita, M.P. DeLisio, Dept. of Elect. Engr., Univ. of Hawaii at Manoa, Honolulu, Hawaii; Y.H. Chung, P.C. Grossman, J. Cowles, H. Wang, A.K. Oki, TRW, Redondo Beach, CA

THIF-28: Flip-chip Mounted Silicon-based Impatt Diodes for Automotive Applications
M. Wollizer, K. Strohm, H. Jorke, J.-F. Luy, Daimler-Benz Research, Ulm, Germany; R.H. Raschofer, E.M. Biebl, Inst. fur Hochfrequenztechnik, TU Munchen, Munchen, Germany

THIF-29: An Advanced Hybrid Assembly Technique for 40 Gbit/s-Modules Including Surface and Feed-through Capacitors
G. Hanke, Deutsche Telekom-FZ211, Darmstadt, Germany; W.-D. Nohr, Deutsche Telekom-FZ246h, Berlin, Germany; D.-J. Weber, Berlin, Germany

THIF-30: Wide Band Transmit Module Designed for Production
T.L. Barkdoll, S.A. Wartenberg, R.W. Mumper, H.C. Heffner, Northrop Grumman Corp., Baltimore, MD

THIF-31: A Low Noise NMOSFET with Overlaid-metal Gate
C.-S. Hsiao, M.-S. Chen, Y.-C. Chiang, Inst. of Elect. Engr., Chang Gung Univ., Tao-Yuan, Taiwan, R.O.C.

THIF-32: Characterization of GaInP Avalanche Transit Time Device in mm-wave Frequencies
C.C. Meng, G.R. Liao, Dept. of Elect. Engr., Nat. Chung-Hsing Univ., Taichung, Taiwan, R.O.C.

THIF-33: A Fully Automated High-accuracy RF/IF Test System for mm- and Submm-wave Mixers
R.J. Dengler, A. Hanapachern (currently with Carnegie Mellon Univ.), P.H. Siegel, Jet Propulsion Lab., Pasadena, CA

THIF-34: 120 and 60 GHz Monolithic InP-based HEMT Sub-harmonic Mixers
Y.-L. Kok, P.-P. Huang, H. Wang, B. Allen, R. Lai, M. Sholley, TRW, Space and Elect. Group, Redondo Beach, CA; T. Gaier, I. Mehdi, Jet Propulsion Lab., Pasadena, CA

THIF-35: A Low-Noise 2.5 THz Heterodyne Receiver with Tunable Reflector Antenna for Atmospheric OH-Spectroscopy
R. Nitsche, R. Titz, DLR-Inst. fur Optoelektronik, Wessling, Germany; E.M. Biebl, Technische Univ. Munchen, Munchen, Germany

THIF-36: Implementing PML Boundary Conditions in TLM
O. Pertz, B. Mueller, U. Mueller, A. Beyer, Dept. of Electromagnetic Theory and Engr., Gerhard-Mercator Univ. Duisburg, Duisburg, Germany

THIF-37: Efficient Phenomenologically-based 1-D Evaluation of the Impedance Matrix in a MPIE Analysis of Planar Microstrip Circuits
F. Cervelli, M. Mongiardo, T. Tarricone, Inst. of Electronics, Univ. of Perugia, Perugia, Italy

THIF-38: New 3D Subgrid Technique for the Finite Difference Method in the Frequency Domain
R. Lotz, J. Ritter, F. Arndt, Microwave Dept., Univ. of Bremen, Bremen, Germany

THIF-39: Modal Analysis of the Slotted-circular Coaxial Cavities Used in Space-harmonic mm-wave Magnetrons
J.-Y. Raguin, K. Schunemann, Technische Univ. Hamburg-Harburg, Hamburg, Germany

THIF-40: Efficient Integral Equation Formulations for Admittance or Impedance Representation of Planar Waveguide Junctions
G. Gerina, M. Guglielmi, European Space Research and Technology Centre, Noordwijk, The Netherlands; G. Lastoria, Univ. of Pavia, Pavia, Italy

THIF-41: Efficient Admittance Matrix Representation of a Cubic Junction of Rectangular Waveguides
V.E. Boria, Dept. of Communications, Univ. Politecnica de Valencia, Valencia, Spain; M. Guglielmi, European Space Res. and Technol. Centre, Noordwijk, The Netherlands

THIF-42: A General-purpose Circuit Model of Interdigital Capacitor for Accurate Design of Low-loss Microstrip Circuit
L. Zhu, K. Wu, Dept. de Genie Elect. et de Genie Info., Ecole Polytechnique de Montreal, Montreal, Canada

THIF-43: A Trust Region Aggressive Space Mapping Algorithm for EM Optimization
M.H. Bakr, J.W. Bandler, R.M. Biernacki, S.H. Chen, K. Madsen, Dept. of Elect. and Comp. Engr., McMaster Univ., Hamilton, Ontario, Canada

THIF-44: A Robust and Efficient Method for the Frequency Domain Analysis of Non-uniform Lossy Multi-line Transmission Systems
N. Bouljfen, A.B. Koukli, F.M. Ghannouchi, Dept. of Elect. and Comp. Engr., Ecole Polytechnique de Montreal, Montreal, PQ, Canada

THIF-45: A Hierarchical Neural Network Approach to the Development of Library of Neural Models for Microwave Design
F. Wang, V.K. Devabhaktuni, G. Wilson, Q.J. Zhang, Dept. of Electronics, Carleton Univ., Ottawa, Ontario, Canada

THIF-46: Automated Design of Microwave Devices Using Full EM Optimization Method
S. Bila, D. Baillargeat, S. Verdeyme, P. Guillon, I.R.C.O.M.-UMR CNRS, Limoges, France

THIF-47: Efficient CAD of Discontinuities between Elliptical and Circular Waveguides
C. Tomassoni, M. Mongiardo, Inst. of Electronics, Univ. of Perugia, Perugia, Italy

THIF-48: Microwave Module Design Applying a Global Electromagnetic Analysis
F. Bodereau, D. Baillargeat, S. Verdeyme, M. Aubourg, P. Guillon, I.R.C.O.M.-UMR CNRS, Limoges, France

THIF-49: A Partitioning Approach to Large Scale Electromagnetic Problems Applied to an Array of Microstrip Coupled Slot Antennas
M.N. Abdulla, M.B. Steer, Dept. of Elect. and Comp. Engr., North Carolina State Univ., Raleigh, NC

THIF-50: A New Approach to the Optimization of Passive Microwave Structures on the Basis of a FDTD-Method
U. Effing, I. Wolff, Dept. of Electromagnetic Theory and Engr., Univ. of Duisburg, Duisburg, Germany

THIF-51: The Mutual Coupling Effects in Large Microstrip Leaky-mode Array
C.-K.C. Tzuang, C.-N. Hu, Inst. of Elect. Comm. Engr., Nat. Chiao Tung Univ., Hsinchu, Taiwan, R.O.C.

THIF-52: Dispersion Characteristics of Leaky Waves on Lossless and Lossy Slotlines
J. Zehentner, J. Machac, M. Migliozi, Czech Technical Univ., Prague, Czech Republic

THIF-53: Fast and Efficient Mode-matching Analysis of Ridged Circular Waveguide Polarizers
J. Bornemann, S. Amari, Univ. of Victoria, Victoria, Canada; J. Uher, Spar Aerospace Ltd., Canada; R. Vahldieck, ETH Zurich, Switzerland

THIF-54: A Novel High-Q Guide Resonator Using Band-gap Structures
F.-R. Yang, Y. Oian, T. Itoh, Elect. Engr. Dept., Univ. of California, Los Angeles, CA

THIF-55: Surface-wave Elimination in Integrated Circuit Structures with Photonic Band-gap Materials
H.Y.D. Yang, Dept. of Elect. Engr. and Comp. Sci., Univ. of Illinois at Chicago, Chicago, IL

THIF-56: Development of the "Laminated Waveguide"
H. Uchimura, T. Takenoshita, M. Fujii, Kyocera Corp., Kyoto, Japan

THIF-57: Phase Noise on Frequency Measurement Errors of IFM Receivers
K. Tajima, K. Kawaakami, A. Kagohara, K. Itoh, Information Technology R&D Center, Mitsubishi Electric Corp., Kanagawa, Japan

THIF-58: Development of Vertical Interconnect Surface Mount Packages
H. Liang, C. Chun, J. Laskar, Sch. of Elect. and Comp. Engr., Georgia Inst. of Technology, Atlanta, GA; D. Estrieche, Hewlett-Packard Co., Santa Clara, CA

THIF-59: RF and Mechanical Characterization of Flip-chip Interconnects in CPW Circuits with Underfill
Z. Feng, W. Zhang, B. Su, K.C. Gupta, Y.C. Lee, NSF Center, Univ. of Colorado at Boulder, Boulder, CO

THIF-60: Design and Implementation of a Microwave Packaging Materials Database
M. Harris, C. Erichsen, M. Dobbs, Georgia Tech Research Inst., Atlanta, GA; C. Lesniak, Solid State Electronics Directorate, Wright Lab., Wright-Patterson AFB, OH

THIF-61: Characterization of Plated Via Hole Lenses for Isolation between Stripline Circuits in LTCC Packages
G.E. Ponchak, J.-G. Yook, NASA Lewis Research Center, Cleveland, OH; D. Chen, L.P.B. Katehi, EECS Dept., Univ. of Michigan, Ann Arbor, MI

THIF-62: Ultra Low-cost Membrane Technology for Millimeter-wave Applications
Ch. Person, S. Perrot, L. Carre, S. Toutain, J.P. Coupez, LEST ENST, Brest, France; G. Legeay, P. Morillon, SAT/STCE, Lannion, France

THIF-63: A Fast Frequency Switching Synthesizer with an Integration Circuit
H. Nosaka, A. Yamagishi, NTT Wireless Systems Labs., Kanagawa, Japan; T. Nakagawa, STE Telecommunications, Tokyo, Japan

THIF-64: InP Heterojunction Bipolar Transistor Decision Circuits
L. Samoska, R. Pullela, B. Agarwal, D. Mensa, Q. Lee, V. Kaman, J. Guthrie, M.J. Rodwell, Dept. Elect. and Comp. Engr., Univ. of California, Santa Barbara, CA

THIF-65: A Wide-band Low-distortion Ferrimagnetic Attenuator
C. Trask, ATG Design Services, Tempe, AZ

THIF-66: CMOS RF Circuits for Integrated Wireless Systems
R.H. Caverly, J. Hu, R. Nichols, Dept. of Elect. and Comp. Engr., Villanova Univ., Villanova, PA; S. Smith, Dept. of Elect. and Comp. Engr., UMASS Dartmouth, N. Dartmouth, MA

THIF-67: Modeling of Spiral Inductors on Lossy Substrates for RFIC Applications
R.D. Lutz, Y. Hahm, A. Weisshaar, V.K. Tripathi, Elect. and Comp. Engr. Dept., Oregon State Univ., Corvallis, OR; A. Grzegorek, W. McFarland, HP Labs, Palo Alto, CA; J. Meyer, HP EEsos Div., Santa Rosa, CA

THIF-68: Sub-micron Silicon RFIC Technologies: An Overview
D.K. Lovelace, J.L. Finol, J.C. Durec, Motorola Semiconductor Products Sector, Tempe, AZ

THIF-69: Extraction of Parasitic Parameters of Dummy Devices on Different Silicon Substrates
L.P. Chen, Y.P. Ho, D.C. Lin, B.M. Tseng, H.Y. Lee, R.F. Guan, G.W. Huang, Nat. Nano Device Labs., Hsinchu, Taiwan, R.O.C.

THIF-70: Parasitic-aware Design and Optimization of CMOS RF Integrated Circuits
R. Gupta, Dept. of Elect. and Comp. Engr., Oregon State Univ., Corvallis, OR; D.J. Allstot, Dept. of Elect. Engr., Arizona State Univ., Tempe, AZ

THIF-71: A Two Dimensional Newton Iterative Scheme for High Contrast Full Scale Microwave Tomography
A.E. Souvorov, A.E. Bulyshev, S.Y. Semenov, R.H. Svenson, G.P. Tatsis, Laser and Applied Tech. Lab, Carolinas Medical Center, Charlotte, NC; A.G. Nazarov, Y.E. Sizov, Kurchatov Inst. of Atomic Energy, Moscow, Russia

THIF-72: Calibration of a Quasi-optical Reflectometer by Means of a Mixed Time/Frequency Domain Method
G.L. Friedsam and E.M. Biebl, Lehrstuhl for Hochfrequenztechnik, TU Munich, Munchen, Germany

TH1A Active and Planar Filters

Chair: Y.-C. Shih,
MMCOMM Inc.

ROOM 307/308

TH1B Commercial and Industrial Microwave Systems

Joint ARFTG/IMS Session
Chair: R.G. Ranson, Filtronic COMTEK
Co-chair: D. Meharry, Lockheed-Martin
ROOM 309/310

TH1C Devices for Microwave Photonic Systems

Chair: C. Gee, Ortel Corp.
Co-chair: A. Gopinath,
University of Minnesota
ROOM 314/317

8:00 AM

TH1A-1: Frequency Hopping Evanescent Mode Filter
J. Sherman, Raytheon E-Systems, St. Petersburg, FL

TH1B-1: Miniature P-code GPS Translator
J. Smuk, P. Blount, C. Trantanella, M. Shifrin,
Hittite Microwave Corp., Woburn, MA

TH1C-1: High Spectral Purity Millimeter-wave Modulated Optical Signal Generation Using Fibre Grating Lasers
F.N. Timofeev, S. Bennett, R. Griffin, P. Bayvel, A.J. Seeds, Dept. of Electronic and Elec. Engr., Univ. College London, UK; R. Wyatt, R. Kashyap, M. Robertson, BT Research Labs., Ipswich, UK

8:20 AM

TH1A-2: Optimization of Noise Performance for Various Topologies of Microwave Active Recursive Filters
H. Ezzedine, M. Delmond, L. Billonnet, B. Jarry, P. Guillon, I.R.C.O.M., Univ. de Limoges, Limoges, France

TH1B-2: A Broadband Linearizer for Ka-band Satellite Communication
W.-M. Zhang, C. Yuen, Space Systems Loral, Palo Alto, CA

TH1C-2: Optically Powered Remote Optical Field Sensor System Using an Electroabsorbing-modulator
R. Heinzelmann, A. Stohr, M. Gross, D. Kalinowski, T. Alder, M. Schmidt, D. Jager, Gerhard-Mercator-Univ. Duisburg, Optoelektronik, Duisburg, Germany

8:30 AM

TH1B-3: Procedure for Measurement and Statistical Processing of Upstream Channel Noise in HFC-networks
K. Haelvoet, J. Vandenbruaene, E. Claus, K. De Kesel, L. Martens, IMEC-INTEC, Univ. of Gent, Gent, Belgium

TH1C-3: Third-order Intermodulation Distortion in an Optical Downconverter
P.D. Biernacki, L.T. Nichols, R.D. Esman, Naval Research Lab., Washington, DC

8:40 AM

TH1A-3: A GaAs MMIC Active Filter with Low Noise and High Gain
F. Sabouri-S., Inst. of Electronic Systems, Aalborg Univ., Aalborg East, Denmark

TH1C-4: Distributed Velocity-matched 1.55 μm InP Traveling-wave Photodetector for Generation of High mm-wave Signal Power
M. Alles, D. Jager, Fac. Optoelektronik; U. Auer, F.-J. Tegude, Fac. Halbleitertechnik/Halbleitertechnologie, Gerhard-Mercator Univ. Duisburg, Duisburg, Germany

8:50 AM

TH1A-4: Low Loss Micromachined Elliptic Filters for Millimeter Wave Telecommunication Systems
P. Blondy, D. Cros, I.R.C.O.M. UMR CNRS, Limoges, France; A.R. Brown, G.M. Rebeiz, Elect. Engr. and Comp. Sci. Dept., Univ. of Michigan, Ann Arbor, MI

TH1B-4: Novel Microwave Vibration Monitoring System for Industrial Power Generating Turbines
C. Staphelbauer, M. Vossiek, A. Schulze, M. Wagner, P. Heide, Siemens AG, Corp. Technology, Munich, Germany; R. Weigel, Johannes Kepler Univ., Linz, Austria; N. Vortmeyer, Siemens AG, Power Generation Group, Muhlheim, Germany

TH1C-5: High Power, High Frequency Traveling Wave Heterojunction Phototransistors with Integrated Polymide Waveguide
D.C. Scott (now with TRW), D.P. Prakash (now with IBM), H. Erlig, D. Bhattacharya, M.E. Ali, H.R. Fetterman, Univ. of California, Los Angeles, CA; M. Matloubian, Hughes Research Labs, Malibu, CA

9:00 AM

TH1A-5: Micromachined Filters on Synthesized Substrates
R.F. Drayton, EECS Dept., The Univ. of Illinois at Chicago, Chicago, IL; S. Pacheco, J.-G. Yook, L.B. Katehi, EECS Dept., Univ. of Michigan, Ann Arbor, MI

TH1B-5: Integrated 5.8 GHz Phased Array Antenna for Electronic Toll Collection
G. Villino, C. Passmann, D. Mansen, C. Brenzel, T. Wixforth, Robert Bosch GmbH, Hildesheim, Germany

9:10 AM

TH1A-6: A Design of Novel Asymmetrically Coupled CPW Bandpass Filter Using TEM Analysis
J.-S. Park, J. Kim, T. Itoh, Dept. of Elect. Engr., Univ. of California, Los Angeles, CA; D. Ahn, Dept. Electronics, Soon Chumhyang Univ., Korea; J.-B. Lim, Dept. Electronics, Kookmin Univ., Korea

TH1C-6: Tapered Slot Antenna Integrated with Velocity-matched Distributed Photodetector
B.-S. Ke, T. Chau, Y. Qian, M.-C. Wu, T. Itoh, Dept. of Elect. Engr., Univ. of California, Los Angeles, CA

9:20 AM

9:30 AM

TH1A-7: A New Miniature Uniplanar Lowpass Filter Using Series Resonators
A. Hettak, G. Delisle, INRS-Telecommunications, Ile du Soeurs, PQ, Canada

TH1C-7: InP-based Gilbert Cell Phase Detector for Generation of Stable Dense Wavelength Division Multiplexing Channel Offsets Using an Optical Phase-locked Loop
P.G. Goetz, H. Eisele, K.C. Syao, K. Yang, P. Bhattacharya, Dept. of Elect. Engr. and Comp. Sci., Univ. of Michigan, Ann Arbor, MI

TH1D Application Oriented Techniques in Field Theory

Chair: F. Arndt, University of Bremen
Co-chair: A. Beyer,
University of Duisburg
Room 318/323

TH1E Multilayer and 3D Hybrid Technology

Chair: C. Buntschuh,
Microwave Engineering Services
Co-chair: J. Pierro, AIL Systems

Room 327/329

8:00 AM

TH1D-1: A Wavelet Based Time Domain Moment Method for the Analysis of Three-dimensional Electromagnetic Fields

M. Werthen, I. Wolff, Inst. of Mobile and Satellite Comm. Tech., Gerhard-Mercator Univ. Duisburg, Duisburg, Germany

TH1E-1: Design of Embedded Passive Components in Low-temperature Cofired Ceramic on Metal (LTCC-M) Technology

A. Fathy, V. Pendrick, G. Ayers, B. Geller, Y. Narayan, B. Thaler, H.D. Chen, M.J. Liberatore, J. Prokop, Sarnoff Corp., Princeton, NJ; K.L. Choi, M. Swaminathan, Georgia Inst. of Technology, Atlanta, GA

8:20 AM

TH1D-2: Electromagnetic Propagation into Reinforced-concrete Walls

E. Richalot, M. Bonilla, M.F. Wong, J. Wiart, France Telecom CNET, DMR/RMC, France; V. Faud-Hanna, Univ. Pierre et Marie Curie (Paris 6), France; H. Baudrand, ENSEEIHT, France

TH1E-2: Design and Performance of UHF Band Inductors, Capacitors and Resonators Using LTCC Technology for Mobile Radio Applications

W. Eurskens, W. Wersing, S. Gohlke, Siemens AG, Corp. Research and Tech. Ctr. Munich, Germany; V. Wannemacher, P. Hild, Siemens AG, Private Comm. Sys., Munich, Germany; R. Weigel, Univ. of Linz, Linz, Austria

8:30 AM

TH1D-3: Design of Photonic Band-gap Substrates for Surface Wave Suppression

R. Coccioli, T. Itoh, Elect. Engr. Dept., Univ. of California, Los Angeles, CA

TH1E-3: 3D Microwave Modules for Space Applications

P. Monfraix, P. Ulian, C. Drevon, S. George, A. Coello Vera, C. Tronche, J.L. Cazaux, ALCATEL ESPACE, Toulouse, France; O. Llopis, J.L. Graffeuil, LAAS CNRS Groupe CCM, Toulouse, France

8:40 AM

TH1D-4: Electromagnetic Field Coupling to Multiconductor Transmission Lines in a Multi-layered Medium

I. Erdin, R. Khazaka, M. Nakhala, Dept. of Electronics, Carleton Univ., Ottawa, Ontario, Canada

TH1E-4: An Embedded Transmission Line Micro-ball Grid Array X-band Power Amplifier

T. Budka, L. Stiborek, L. Heinrich, C. Kyhl, Raytheon TI Systems, Dallas, TX

8:50 AM

TH1D-5: Efficient Analysis of Microstrip Radiation by the TLM-integral Equation (TLMIE) Method

L. Pierantoni, S. Lindenmeier, P. Russer, Lehrstuhl für Hochfrequenztechnik, TI München, München, Germany

TH1E-5: Methodology for Creating Embedded Transmission Line 90 Bend and Shunt Capacitor Models

B. Heimer, T. Budka, Raytheon TI Systems, Dallas, TX

9:00 AM

TH1D-6: Fast Subgrid FD-TD Matrix Pencil Technique for the Rigorous Analysis of Resonant 3D Microwave Structures

J. Ritter, F. Arndt, Microwave Dept., Univ. of Bremen, Bremen, Germany

TH1E-6: NRD Guide Couplers Combined with Microwave Integrated Circuits in Side-by-Side Alignment

T. Goi, S. Kawasaki, Dept. of Comm. Engr., Tokai Univ., Kanagawa, Japan; T. Itoh, Dept. of Elect. Engr., UCLA, Los Angeles, CA; T. Yoneyama, Res. Inst. of Elect. Comm., Tohoku Univ., Sendai, Japan

9:10 AM

TH1D-7: Efficient Hybrid Mode-matching/Finite-element (MM/FE) Method for the Design of Waveguide Components and Slot Radiators

R. Beyer, F. Arndt, Microwave Dept., Univ. of Bremen, Bremen, Germany

9:20 AM

9:30 AM

THURSDAY

TH2A High Q Filters

Chair: M. Guglielmi,
European Space Agency

ROOM 307/308

TH2B Microwave Measurements

Chair: C. Weil, NIST
Co-chair: M. Solomon,
MITRE Corp.

ROOM 309/310

**TH2C Optical Beam-forming
for Phased Arrays**

Focused Session
Chair: A. Seeds, University College-London
Co-chair: D. Zimmerman, Raytheon TI Systems
ROOM 314/317

10:10 AM

TH2A-1: A New Planar Type Dielectric Resonator for Microwave Filtering
S. Moraud, S. Verdeyme, P. Guillon, I.R.C.O.M.-UMR CNRS, Limoges, France; P. Ulian, B. Theron, ALCATEL ESPACE, Toulouse, France

10:30 AM

TH2A-2: K-band Planar Type Dielectric Resonator Filter with High- ϵ Ceramic Substrate
T. Hiratsuka, T. Sonoda, K. Sakamoto, Y. Ishikawa, Murata Manufacturing Co. Ltd., Kyoto, Japan

10:40 AM

TH2A-3: Dielectric Combline Resonators and Filters
C. Wang (now with CELWAVE, Marlboro, NJ), K.A. Zaki, Elect. Engr. Dept., Univ. of Maryland, College Park, MD; A.E. Atia, Orbital Sci. Inc., Germantown, MD; T. Dolan, K&L Microwave Inc., Salisbury, MD

10:50 AM

TH2A-4: High Temperature Superconducting-shielded High Power Dielectric Dual-mode Filter for Applications in Satellite Communications
S. Schornstein, I.S. Ghosh, N. Klein, Inst. für Festkörperforschung, Forschungszentrum Jülich GmbH, Jülich, Germany

11:00 AM

TH2B-1: DC-to-mm-wave-Absolute Potential Measurements inside Digital Microwave ICs Using a Micromachined Photoconductive Sampling Probe
G. David, J.F. Whitaker, Dept. EECS, Univ. of Michigan, Ann Arbor, MI; T.R. Weatherford, NPS, Monterey, CA; K. Jobe, S. Meyer, M. Bustamante, W. Goyette, Hughes Space and Comm., LA, CA; S. Thomas III, K. Elliott, Hughes Research, Malibu, CA

TH2B-2: Mapping of the Thickness of Conducting Layers by mm-wave Near-field Microscope
A.F. Lann, M. Golosovsky, D. Davidov, Racah Inst. of Physics, Hebrew Univ. of Jerusalem, Israel; A. Frenkel, MSI Engineering Software, Tel-Aviv, Israel

TH2B-3: Localized Circuit Probing with a Combined Schottky Diode/Scanning Force Microscope
D.W. Van Der Weide, V. Agrawal, T. Bork, Dept. of Elect. and Comp. Engr., Univ. of Delaware, Newark, DE

TH2B-4: Accurate Extraction Method for 1/f Noise Parameters Used in Gummel-Poon Type Bipolar Junction Transistor Models
F.X. Sinnesbichler, G.R. Olbrich, Lehrstuhl für Hochfrequenztechnik, TU München, München, Germany; M. Fischer, Siemens AG München, München, Germany

TH2B-5: W Band Silicon Dielectric Resonator for Semiconductor Substrate Characterization
P. Blondy, D. Cros, P. Guillon, I.R.C.O.M.-UMR CNRS, Limoges, France; F. Balleras, C. Massit, LETI-CEA, Grenoble, France

11:10 AM

TH2A-5: Novel Helical Resonator Filter Structures
S.J. Fiedziusko, R. Kwok, Space Systems/LORAL, Palo Alto, CA

11:20 AM

TH2B-6: Measurement of the Broadband Microwave Absorption and Shielding Characteristics of a Conductive Polymer
K. Naishadham, Dept. of Elect. Engr., Wright State Univ., Dayton, OH; P. Chandrasekhar, Ashwin-Ushas Corp., Frehold, NJ; R.A. Neidhard, Electronic Devices Div., Wright Lab., Wright Patterson AFB, OH

11:30 AM

TH2B-7: Analytical Expressions of Transient Thermal Response of Self-heating Semiconductor Devices
Y. Zhu, J.K. Twynam, M. Yagura, M. Hasegawa, Y. Eguchi, A. Yamada, E. Susematsu, Z. Sakumo, H. Sato, N. Hashizume, Central Research Lab., SHARP Corp., Nara, Japan

11:40 AM

TH2A-6: Synthesis of Delay Filters
D. Chambers, Filtronic Comtek Inc., Salisbury, MD; Y. Huang, Filtronic Comtek Inc., Merrimack, NH

TH2C-1: New Array Capabilities by Photonic Beamforming
R.D. Esmann, M.Y. Frankel, P.J. Matthews, Naval Research Lab., Washington, DC

TH2C-2: Optically Controlled Serially Fed Phased Array Radar
Y. Chang, H.R. Fetterman, Elect. Engr. Dept., Univ. of California, Los Angeles, CA; B. Tsap, Pacific Wave Ind. Inc., Los Angeles, CA; A.F.J. Levi, D.A. Cohen, Elect. Engr. Dept., Univ. of SC, Los Angeles, CA; I.L. Newberg, Hughes, LA, CA

TH2C-3: Beam-forming Network Characteristics of Spatial Optical Signal Processing Array Antenna for Multibeam Reception
O. Shibata, K. Inagaki, Y. Karasawa (now with KDD R&D Labs), ATR Adaptive Comm. Res. Labs., Kyoto, Japan,

TH2C-4: Ultimate Beam Capacity Limit of Fiber Grating Based True-time-delay Beam-formers for Phased Arrays
R.A. Minasian, K.E. Alameh, Dept. of Elect. Engr. and Australian Photonics CRC, Univ. of Sydney, Australia

TH2C-5: Optical Beamforming Network Based on Chirped Fiber Gratings Continuously Variable True-time Delay Lines
J.L. Corral, J. Marti, J.M. Fuster, ETSI Telecomunicación, Valencia, Spain

TH2C-6: All-optically Controlled Beam-scanning Array for Antenna Remoting Applications
W.R. Deal, T. Jung, M.C. Wu, T. Itoh, Univ. of California, Los Angeles, CA

TH2C-7: Microwave Phase Conjugation Using Optically Interconnected Phased Arrays
Y. Chang, H.R. Fetterman, Elect. Engr. Dept., Univ. of California, Los Angeles, CA; I.L. Newberg, S.K. Panaretos, Hughes Aircraft Co., Los Angeles, CA

TH2D Time Domain Methods, II
Chair: A.C. Cangellaris, University of Illinois
Co-chair: W.J.R. Hoefer, University of Victoria

ROOM 318/323

TH2E Frequency Conversion Technology
Chair: A. Khanna, Hewlett-Packard

ROOM 327/329

10:10 AM

TH2D-1: Formulation of a Haar-wavelet-based Multi-resolution Analysis Similar to the 3-D FDTD Method
M. Fujii, W.J.R. Hoefer, Dept. of Elect. and Comp. Engr., Univ. of Victoria, Victoria, BC, Canada

TH2E-1: A Modified Feed-forward Technique for Mixer Linearization
T.J. Ellis, The Radiation Lab., Univ. of Michigan, Ann Arbor, MI

10:30 AM

TH2D-2: Nonlinear Circuit Characterization Using a Multiresolution Time Domain Technique (MRTD)
L. Roselli, Univ. of Perugia, Perugia, Italy; E.M. Tentzeris, L.P.B. Katehi, Radiation Lab., EECS Dept. Univ. of Michigan, Ann Arbor, MI

TH2E-2: A New FET Frequency Multiplier
M. Jonsson, H. Zirath, K. Yhland, Dept. of Microwave Technology, Chalmers Univ. of Technology, Gothenburg, Sweden

10:40 AM

TH2D-3: Time Domain Characterization of Coupled Electromagnetic/Thermal Phenomena for Material Processing
M. Righi, W.J.R. Hoefer, Dept. of Elect. and Computer Engr., Univ. of Victoria, Victoria, BC, Canada; J.L. Herring, Schumberger Geo Quest, Oxfordshire, UK

TH2E-3: Distributed Broadband Frequency Translator
P. Akkaraekthalin, S. Kee, D.W. Van Der Weide, Dept. of Elect. and Comp. Engr., Univ. of Delaware, Newark, DE

11:00 AM

TH2D-4: A Fully Integrated Multiconductor Model for TLM
A. Wlodarczyk, V. Trekic, R. Scaramuzza, Kimberley Comm. Consultants Ltd., Nottingham, UK; C. Christopoulos, Dept. of Elect. and Electronic Engr., Univ. of Nottingham, Nottingham, UK

TH2E-4: A Compact Subharmonically Pumped MMIC Self Oscillating Mixer for 77 GHz Applications
M.J. Roberts, S. Iezekiel, C.M. Snowden, School of Electronic and Elect. Engr., Univ. of Leeds, Leeds, UK

11:10 AM

TH2D-5: A Systematic Approach to the Problem of Equivalent Circuit Model Generation
T. Mangold, P. Russer, Inst. für Hochfrequenztechnik, TU München, München, Germany

11:20 AM

TH2E-5: Low Cost Coplanar 77 GHz Single Balanced Mixer Using Ion-implanted GaAs Schottky Diodes
R. Shimon, D. Caruth, J.R. Middleton, H. Hsia, M. Feng, Dept. of Elect. and Comp. Engr., Univ. of Illinois, Urbana, IL; J. Mondal, S. Moghe, Northrop Grumman Corp., Rolling Meadows, IL

11:30 AM

TH2D-6: Analysis of MQW and Anisotropic Guided Wave Structures Using the Full-wave 2D TLM-based FD-TD Method
Z. Chen, M.L. Lui, Dept. of Elect. and Comp. Engr., DalTech, Dalhousie Univ., Halifax, Nova Scotia, Canada

TH2E-6: A mm-wave Monolithic Even Harmonic Image Rejection Mixer
K. Kawakami, M. Shimozaawa, H. Ikematsu, K. Itoh, Y. Isota, O. Ishida, Info. Technology R&D Center, Mitsubishi Electric Corp., Kamakura, Japan

11:40 AM

TH2D-7: Partially Prizm-gridded FDTD Analysis for Layered Structures of Transversely Curved Boundry
C.-T. Hwang, R.-B. Wu, Dept. of Elect. Engr., National Taiwan Univ., Taipei, Taiwan

TH2E-7: X-band Regenerative Dividers with Low Phase Noise
E.S. Ferre-Pikal, F.L. Walls, Nat. Inst. of Standards and Technology (NIST), Boulder, CO

ALSO OCCURRING

Thursday 12:00–1:15 PM

RF and Microwave Education Forum

RF and microwave educators, and others with serious interest in education matters, are invited to this forum for a stimulating hour of discussion on issues of current importance, to network with others with similar interests and to contribute, as well as hear ideas about RF and microwave education. This discussion will be led by key speakers who will briefly present their opinions on controversial topics. Thereafter, members of the audience will be invited to ask questions, present alternative views, report their experiences and initiate discussion on other issues of interest. Please feel free to bring one or two overhead transparencies to support your comments. A list of attendees will be circulated for networking and continued dialog. For further details and to confirm your intention to participate, please contact Dr. Madhu Gupta at m.gupta@ieee.org.

**Baltimore Convention Center
Room 343**

THURSDAY

TH3A Quasi-optical Amplifier Arrays

Chair: M. Delisio,
University of Hawaii

ROOM 307/308

TH3B Network Measurements

Chair: L. Dunleavy,
University of South Florida
Co-chair: E. Strid, Cascade Microtech

ROOM 309/310

TH3C Photonics for Wireless and Radar Systems

Chair: A. Paolella, Lockheed-Martin
Co-chair: R. Esman,
Naval Research Lab
ROOM 314/317

1:20 PM

TH3A-1: A Ka Band Monolithic Quasi Optic Amplifier
E.A. Sovero, J.B. Hacker, J.A. Higgins, D.S. Deakin,
A.L. Sailer, Rockwell Int. Science Center,
Thousand Oaks, CA

TH3B-1: W-band On-wafer Load-pull Measurement System and Its Application to HEMT Characterization
E. Alexseev, D. Pavlidis, Dept. of Elect. Engr. and Comp. Science, Univ. of Michigan, Ann Arbor, MI; C. Tsironis, Focus Microwaves Inc., St. Laurent, PQ, Canada

TH3C-1: Broadband mm-wave Fiber-radio Network Incorporating Remote Up/Downconversion
G.H. Smith, D. Novak, Dept. of Elect. and Electronic Engr., Univ. of Melbourne, Melbourne, Australia

1:30 PM

TH3A-2: 20 Watt Spatial Power Combiner in Waveguide
N.-S. Cheng, A. Alexanian, R. York, Dept. of Elect. and Comp. Engr., Univ. of California, Santa Barbara, CA; M.G. Case, Hughes Research Labs, Malibu, CA

TH3B-2: W-band MMIC Power Amplifier Characterization Using On-wafer Pulsed Power Test
D.C. Yang, J.M. Yang, H. Wang, P. Huang, TRW Inc., RF Product Center, Redondo Beach, CA

TH3C-2: A Wireless LAN at 60 GHz-Novel System Design and Transmission Experiments
K. Kojucharow, H. Kaluzni, M. Sauer, W. Nowak, Comm. Lab., Dresden Univ. of Technology, Dresden, Germany

1:50 PM

TH3A-3: A 10 GHz High-efficiency Lens Amplifier Array
E.W. Bryerton, M.D. Weiss, Z. Popovic,
Univ. of Colorado, Boulder, CO

TH3B-3: Accuracy of Lumped-element Calibrations for Four-sampler Vector Network Analyzers
R.B. Marks, J.A. Jargon, Nat. Inst. of Standards and Technology (NIST), Boulder, CO; D.K. Rytting, Hewlett-Packard Co., Santa Rosa, CA

TH3C-3: Intrinsic Microwave Phase Noise of Fiber-optic Links
P.J. Matthews, R.D. Esman, Optical Sciences Div., Naval Research Lab., Washington, DC

2:00 PM

TH3B-4: Complete 3-port Measurement of Microwave Mixers Using a Nonlinear Vectorial Network Analyser
Y. Rolain, P. Vael, W. Van Moer, A. Barel, Dept. Elec., Vrije Univ., Brussels, Belgium

2:10 PM

TH3B-5: Measuring Transistor Dynamic Loadlines and Breakdown Currents Under Large-signal High-frequency Operating Conditions
J. Verspecht, Hewlett-Packard Network Meas. and Description Group, VUB-ELEC, Brussels, Belgium

2:20 PM

TH3A-4: A CPW Fed Microstrip Patch Quasi-optical Amplifier Array
S. Ortiz, T. Ivanov, A. Mortazawi, Dept. of Elect. and Comp. Engr., Univ. of Central Florida, Orlando, FL

TH3C-4: Photonic Remoting of the Receiver of an Ultra High Dynamic Range Radar
J.E. Roman, L.T. Nichols, K.J. Williams, R.D. Esman, Optical Sci. Div, G.C. Tavik, M. Livingston, Code 5327 Radar Div., M.G. Parent, Code 5317 Radar Div., Naval Research Lab., Washington, DC

2:30 PM

TH3A-5: Analysis and Measurement of Hard Horn Feeds for the Excitation of Quasi-optical Amplifiers
M.A. Ali, S. Ortiz, T. Ivanov, A. Mortazawi, Dept. of Elect. and Comp. Engr., Univ. of Central Florida, Orlando, FL

TH3B-6: Microwave Multisine with Known Phase for Calibration Purpose of Non-linear Vectorial Network Analysers in Narrowband Measurement Mode
A. Barel, Y. Rolain, Dept. ELEC, Vrije Univ. Brussel, Brussels, Belgium

2:40 PM

TH3A-6: An Integrated Electromagnetic and Nonlinear Circuit Simulation Environment for Spatial Power Combining Systems
M.A. Summers, C.E. Christofferson, A.I. Khalil, S. Nakazawa, T.W. Nuteson, M.B. Steer, J.W. Mink, Dept. of Elect. and Comp. Engr., North Carolina State Univ., Raleigh, NC

TH3B-7: A Single Six-port Based Automated Network Analyzer
S. Khouaja, F.M. Ghannouchi, Dept. of Elect. and Comp. Engr., Ecole Polytechnique de Montreal, Montreal, PQ, Canada

TH3C-5: New Carrier Generation Approach for Fiber-radio Systems to Overcome Chromatic Dispersion Problems
A. Hilt, B. Cabon, A. Vilcot, LEMO-INPG-UJF-CNRS, Grenoble, France; T. Berceli, T. Marozsak, BME-MHT, Tech Univ. Budapest, Budapest, Hungary

2:50 PM

TH3C-6: Compensation of Fiber Dispersion in an Optical mm-wave System in the 60 GHz-band
C.G. Schaffer, F.H. Lubeck, Lubeck, Germany; R.-P. Braun, G. Grosskopf, F. Schmidt, Heinrich-Hertz Inst. fur Nachrichtentechnik, Berlin, Germany

TH3D Frequency Domain Techniques

Chair: R. Vahldieck,
Swiss Federal Institute of Technology (ETH)
Co-chair: D. Yang,
University of Illinois at Chicago
 ROOM 318/323

TH3E Signal Generation and Control Devices

Chair: M. Odyniec,
Hewlett-Packard

ROOM 327/329

1:20 PM

TH3D-1: Propagation in a Circular Waveguide Periodically Loaded with Thick Dielectric Disks
 S. Amari, R. Vahldieck, P. Leuchtman, Lab. for Field Theory and Microwave Electronics, Swiss Fed. Inst. of Technology (ETH), Zurich, Switzerland;
 J. Bornemann, Dept. of Elect. and Comp. Engr., Univ. of Victoria, Victoria, BC, Canada

TH3E-1: Micromechanical Electrostatic K-band Switches
 S. Pacheco, L.P.B. Katehi, C.T. Ngyen (Center for Integrated Sensors and Circuits), Radiation Lab., Elect. Engr. and Comp. Sci. Dept., Univ. of Michigan, Ann Arbor, MI

1:30 PM

1:40 PM

TH3D-2: High-Q Rectangular Cavities and Waveguide Filters Using Periodic Metal-dielectric Slabs
 H. Contapanagos, E. Yablonovitch, Dept. of Elect. Engr., Univ. of California, Los Angeles, CA; N.G. Alexopoulos, Dept. of Elect. and Computer Engr., Univ. of California, Irvine, CA

TH3E-2: An MMIC Active Phase Shifter Using a Variable Resonant Circuit
 H. Hayashi, M. Muraguchi, NTT Wireless Sys. Labs, Kanagawa, Japan

1:50 PM

TH3D-3: MoL-mode Analysis with Precise Resolution by an Enhancement and Generalized Line Algorithm
 R. Pregla, Allgemeine und Theoretische Elektrotechnik, Fern Univ., Hagen, Germany

TH3E-3: Digital Vector Control Chip Set at Q Band for Communication Phased Array
 M. Lajugie, H. Brouzes (now with Signaal Hengelo, The Netherlands), F. Villian (now with Hittite Microwave Corp., Woburn, MA), Thomson-CSF, Massy, France

2:00 PM

2:10 PM

TH3D-4: Analysis of MMIC Junctions and Multiports by the Method of Lines
 L. Vietzorreck, Lehrstuhl für Hochfrequenztechnik, TU München, München, Germany; R. Pregla, Fern Univ., Hagen, Germany

TH3E-4: An Analog Frequency-division Approach for Subharmonic Generation in Microwave VCOs
 X. Zhang, I. Gresham, CR&D, AMP M/A-COM, Lowell, MA

2:20 PM

TH3D-5: Mesh Grading and Cutoff Frequencies in the Frequency-domain TLM Method
 J. Hesselbarth, R. Vahldieck, Lab. for Electromagnetic Fields and Microwave Electronics, Swiss Fed. Inst. of Technology (ETH), Zurich, Switzerland

2:30 PM

TH3D-6: A Full-wave Approach to the Modeling of Discontinuities of Real Conductors in Planar Lossy Lines for MMIC Applications
 M. Farina, T. Rozzi, Dept. di Elettronica ed Automatica, Univ. degli Studi di Ancona, Ancona, Italy

TH3E-5: Subharmonically Injection Locked 94 GHz MMIC HEMT Oscillator Using Coplanar Technology
 S. Kudszus, W.H. Haydl, M. Neumann, A. Bangert, A. Hulsmann, Fraunhofer Inst. for Applied Solid State Physics, Freiburg, Germany

2:40 PM

TH3D-7: An Impedance Matrix Transformation for Planary Circuit Integral Equation Solvers
 F. Cervelli, M. Mongiardo, L. Tarricone, Inst. di Elettronica, Perugia, Italy

2:50 PM

TH3D-8: A Simplified MPIE Analysis for Planar Circuits with N-Fold Rotational Symmetry and Lumped Elements
 Y.-J. Chen, Y.-H. Pang, R.-B. Wu, Dept. of Elect. Engr., National Taiwan Univ., Taipei, Taiwan

TH3E-6: The Dielectric Resonator Power Combiner Oscillator: A New Design for Microwave or Monolithic mm-wave Development
 A.A. Sayyah, D.W. Griffin, Dept. of Elect. and Electronic Engr., The Univ. of Adelaide, Adelaide, South Australia

TH4A Active Antennas and Arrays

*Chair: J.F. Harvey,
US Army Research Office*

ROOM 307/308

**TH4B Digital Interconnection Techniques
and Characterization
at GHz Frequencies**

*Chair: D. Williams, NIST
Co-chair: K. Wong, NIST*
ROOM 309/310

**TH4C Microwave Systems
and Applications**

*Chair: R. Dixit, TRW-Transportation Electronics
Co-chair: B. Spielman, Washington University*
ROOM 314/317

3:30 PM

TH4A-1: Phase-locking of Grid Oscillators
W. Wang, L.W. Pearson, Dept. of Elect. and Comp.
Engr., Clemson Univ., Clemson, SC

**TH4B-1: 50 GHz Interconnect Design
in Standard Silicon Technology**
B. Kleveland, T.H. Lee, S.S. Wong, Center for Integrated
Systems, Stanford Univ., Stanford, CA

TH4C-1: Automotive Radar
M. Russel, Raytheon Systems Co., Tewksbury, MA

3:50 PM

**TH4A-2: Spatial Power Combining of Gunn Diodes
Using an Overmoded Waveguide Resonator
at Millimeter Wavelengths**
J. Bae, T. Uno, T. Fujii, K. Mizuno, Research Inst.
of Elect. Comm., Tohoku Univ., Sendai, Japan,
Photodynamics Research Center, The Inst. of Physical
and Chem. Research, Sendai, Japan

**TH4B-2: Accurate Characteristic Impedance
Measurement on Silicon**
D.F. Williams, NIST, Boulder, CO, U. Arz, H. Grabinski,
Univ. Hannover, Hannover, Germany

TH4C-2: Aviation Safety Radar
J. Evans, MIT Lincoln Labs, Lexington, MA

4:10 PM

TH4A-3: Grid Oscillators with Photonic-crystal Reflectors
Q. Sun, K.W. Miyashiro, J.B. Horiuchi, W.A. Shiroma,
Dept. of Elect. Engr., Univ. of Hawaii at Manoa,
Honolulu, HI

**TH4B-3: A Test Board for Multiport Immittance
Measurement and Characterization of RF-IC Packages**
A. Tripathi, R. Lutz, V.K. Trpathi, Dept. of Elect.
and Comp. Engr., Oregon State Univ., Corvallis, OR;
H.H. Wu, J.W. Meyer, HP EEsof, Santa Rosa, CA;
B. Hutchison, HP Microwave Tech. Div.,
Santa Rosa, CA

TH4C-3: Remote Control Functions
E. Pacsai, TRW AEN, Farmington Hills, MI

4:30 PM

**TH4A-4: Surface-wave Coupling of Active Antennas
for Homodyne Sensor Systems**
R.H. Rasshofer, E.M. Biebl, Inst. fur
Hochfrequenztechnik der Technischen, Univ. Munchen,
Munchen, Germany

TH4B-4: Analysis of Microwave Interconnects
R. Abhari, T.E. van Deventer, Dept. of Elect. and Comp.
Engr., Univ. of Toronto, Toronto, ON, Canada

TH4C-4: Navigation Systems
E. Rodemsky, Trimble Corp., Herndon, VA

4:30 PM

**TH4A-5: Broadband Power Amplifier Integrated
with Slot B Antenna and Novel Harmonic
Tuning Structure**
V. Radisic, Y. Qian, T. Itoh, Elect. Engr. Dept.,
Univ. of California, Los Angeles, CA

4:40 PM

**TH4A-6: Cavity Induced Polarization Switching
in a Slot-loop Active Antenna**
Q. Chen, V.F. Fusco, P.S. Hall, Dept. of Elect.
and Electronic Engr., The Queen's Univ. of Belfast,
Belfast, N. Ireland, UK; M. Zheng, School of Electronic
and Elect. Engr., Univ. of Birmingham, Birmingham, UK

4:50 PM

**TH4A-7: Submm-wave Sideband Generation
Using a Planar Diode Array**
D.S. Kurtz, J.L. Hester, T.W. Crowe, R.M. Weikle II,
Univ. of Virginia, Charlottesville, VA; J.B. Hacker,
Rockwell Sci. Ctr., Thousand Oaks, CA; D.B. Rutledge,
California Inst. of Technology, Pasadena, CA

**TH4B-5: Multi-wire Microstrip Interconnections:
A Systematic Analysis for the Extraction
of an Equivalent Circuit**
F. Alimenti, P. Mezzanotte, L. Roselli, R. Sorrentino,
Inst. of Electronics, Univ. of Perugia, Perugia, Italy

TH4C-5: ITS Sensors
B. Hurley, InKobe Corp., Vienna, VA

5:00 PM

**TH4A-8: A Planar Active Lens Oscillator
on a Dielectric Slab**
A.R. Perkons, T. Itoh, Elect. Engr. Dept.,
Univ. of California, Los Angeles, CA

WFA: DESIGNING RF RECEIVERS FOR WIRELESS SYSTEMS**Format:** Tutorial plus Working Forum**Date & Time:** June 12, 1998; 8:00 AM–5:00 PM**Topics and Presenters:**

- *Receiver Design Fundamentals*, **Edward C. Niehenke**, Niehenke Consulting
- *Low Cost CMOS Technology for Wireless Applications*, **Mohamad Megahed**, Peregrine Semiconductor Corp.
- *A Critique of Simulation Techniques for Receiver Performance Prediction*, **Bob Melville**, Lucent Technologies
- *Transceiver Design for Wireless Local Loop Applications*, **John Pierro**, AIL Systems
- *Novel Approach for Local Oscillator Design of Receivers/Transmitters*, **Ulrich L. Rohde**, Synergy Microwave Corp.
- *CDMA Receiver Design*, **Vladislav Sorokine**, QUALCOMM
- *A Low IF Solution for GSM Systems*, **Hong Mo Wang**, Lucent Technologies
- *Low-power Receiver Design Techniques Using Si and CMOS Technology*, **Edward Spears**, Motorola
- *Zero IF (ZIF) Receivers, Design, Challenges and Examples*, **Christopher Wakham**, Nokia

Organizers: Ed Niehenke
Bernard D. Geller, David Sarnoff Research Center
John Pierro
John Sevic, Spectrian Corp.

Sponsors: MTT-6, Microwave
and Millimeter-wave Integrated Circuits
MTT-20, Wireless Communications

Abstract:

RF receivers are key elements in the expanding wireless communications area. Instant communications without interconnecting wires has been a major factor in the explosive growth of communications. Efforts are being directed toward making the receiver smaller, lighter and less expensive using less power. This workshop will focus on the architecture of the RF receiver and receiver configurations to meet system requirements for analog as well as many forms of digital modulation. Receiver nonlinearities as well as source stability issues and their effect on system performance will be presented. Criteria for the selection of IFs and local oscillators for spurious-free operation will be considered. Cost-reduction techniques and MMIC integration of many circuit functions for reduced size will be explored. Finally, new technologies will be considered for further receiver cost reduction and enhanced performance.

WFB: HIGH FREQUENCY SILICON MICROMACHINING AND MULTI-CHIP INTEGRATION**Format:** Tutorial**Date & Time:** June 12, 1998; 8:00 AM–5:00 PM**Topics and Presenters:**

- *Si Micromachining in High Frequency Applications*, **E. Brown**, DARPA
- *MEMS for Communications Systems Applications*, **B. Perlman**, CECOM,
- *SiGe SIMWIC Technology*, **J.-F. Luy**, Daimler-Benz, Ulm, Germany
- *Silicon Technologies for RF Systems up to 40 GHz*, **L. Treitinger**, Siemens, Munich, Germany
- *Design and Application of SIMMWICs*, **P. Russer**, University of Technology, Munich, Germany
- *Modeling Techniques for Micromachined Circuits and Multichip Modules*, **L. Katehi**, **P. Russer**

- *High Efficiency Interconnects for Si-based Applications*, **G. Ponchak**, NASA Lewis; **P. Staecker**, M/A-COM; **C. Goldsmith**, TI/Raytheon

Organizers: L. Katehi
P. Russer
E. Brown

Sponsors: MTT-7, Microwave
and Millimeter-wave Solid-state Devices
RFIC Symposium

Abstract:

Conventional integrated circuits are prone to high radiation and ohmic loss that limit high-frequency applicability. Surface-wave excitation increases coupling between adjacent circuits and imposes requirements for high separation between receive and transmit components, thus compromising density and circuit size. In addition, high propagation loss and coupling considerably reduce combining efficiencies and limit millimeter-wave power. Antennas on high-density substrates suffer from very low efficiency, which results in their use in monolithic designs being seriously compromised by the lack of appropriate substrates. Recent advances in Si fabrication techniques have stimulated new approaches to circuit integration and architecture. Surface or bulk Si micromachining techniques can provide new avenues in circuit integration and packaging along with excellent performance and very low cost. Microelectromechanical components (MEMS) and devices offer the potential for high-speed, low-loss, high-isolation switches; variable matching networks; and phase shifters. Novel techniques for thermal control, including the use of diamond or SiN films, microfluidic cooling and electronic self-cooling, have been investigated to increase circuit performance and density. These micromachined geometries result in low-dispersion, low-loss wave propagation and reduced cross talk, thus creating possibilities for very high-density, high-frequency circuits. The efficient guidance of the electromagnetic waves through vertically and horizontally densely integrated subsystems requires extensive understanding of the associated propagation phenomena and development of high-frequency design rules. MCM techniques combined with the use of Si promise dense, 3-D integration in addition to excellent performance. The use of glass-on-Si or polymer films for the development of multichip modules offers promise for applications exceeding the microwave-frequency range. Si-based flip-chip circuits can provide a low-cost alternative to millimeter-wave monolithic circuits with much higher yield. Yet, high-frequency electromagnetic effects on chip are becoming serious barriers to extending the operating range of frequencies. The effects of low-resistivity Si on wave propagation and the possibility of reducing loss by incorporating appropriate dielectric buffer are important issues that must be addressed. This workshop will focus on the most recent developments in this emerging area. Speakers from industry, research labs and academia will address wave guidance, interconnect and component design issues as well as applications to microwave and millimeter-wave power circuits, sensors, reconfigurable networks and high-density T/R modules.

WFC: THE EMERGENCE OF MILLIMETER-WAVE VIDEO-ON-DEMAND SYSTEMS**Format:** Tutorial plus Working Forum**Date & Time:** June 12, 1998; 8:00 AM–5:00 PM**Topics and Presenters:**

- *Market Trends Europe*, **Paul Jackson**, **Helen Duncan**, Microwave Engineering Europe, UK
- *Market Trends Americas*, **George Bechtel**, Strategies Unlimited, USA
- *Propagation and Standardization Issues for 42 GHz MVDS Systems*, **Rolf Jacoby**, Technical University of Darmstadt, Germany

- *MVDS/LMDS Activities Europe*, **Dave Palmer**, Philips Broadband Networks, UK
- *European System Approach for MVDS*, **Enzo Ardemagni**, Technosystems, Roma, Italy
- *European MMIC Technology for MVDS*, **Heinrich Dämbkes**, PDG United Monolithic Semiconductors, France and Germany
- *MVDS at 38 GHz Using PHEMTs*, **Fred Myers**, GEC Marconi Materials Technology, UK
- *American System Approach*, **Roy Hebert**, M/A-COM, Lowell, MA, USA
- *MVDS TX & RX Modules at 42 GHz*, **Lamberto Raffaelli**, ARCOM, NH, USA

Organizers: Holger H Meinel,
Daimler-Benz Aerospace AG, Germany
Terry H. Oxley, consultant, UK
John Horton, TRW, USA

Sponsor: MTT-16, Microwave Systems

Chairman/Moderator:
Holger Meinel

Abstract:

Ongoing advances in micro-/millimeter-wave technology have made new frequency ranges commercially feasible. Besides local multi-point distribution systems (LMDS) at 28/29 GHz, microwave video distribution systems (MVDS) at 42 GHz are another example of this type of broadband two-way data communication system. However, MVDS is a one-way broadband system only. A narrow-bandwidth requirement for the back channel makes even telephone line employment possible. Market forecasts and trends for such systems in Europe as well as in the Americas will be reviewed. System aspects and different approaches in the system implementation will be presented as well the specific design of MVDS systems for consumer applications as envisioned by different contributors in the field. Emphasis will be placed on hardware implementation challenges (such as cost and long-term reliability) of this new consumer-driven market.

WFD: COMPUTER-AIDED DESIGN FOR MANUFACTURABILITY

Format: Advanced Topics with Tutorial

Date & Time: June 12, 1998; 8:00 AM–5:00 PM

Topics and Presenters:

- *Computer Integrated Manufacturing: Key to Survival*, **Jeanne Pavio**, Motorola
- *Linking Methodologies for Process Related Microwave CAD in the Context of the European EDGE Project*, **Rolf Jansen**, Aachen
- *CAD with Tolerances*, **John Bandler**, Bandler Corp. and McMaster University, Canada
- *Signal Integrity Analysis and Optimization in High-speed Designs*, **Michel Nakhla**, Carleton University
- *The Role of CAD Tools in the Design and Manufacturing of Microwave Filters*, **Raafat Mansour**, ComDev
- *Manufacturing-oriented Design of Waveguide Components*, **Mauro Mongiardo**, Università degli studi di Perugia, Italy
- *CAD of Waveguide Components, Networks and Horn Antennas with Fast Mode-matching Hybrid Techniques*, **Fritz Arndt**, Bremen
- *Active Device Modeling for Statistical Circuit Simulation and GaAs IC Manufacturing*, **David Root**, Hewlett-Packard

Organizers: John W. Bandler
Mauro Mongiardo

Sponsor: MTT-1, Computer-aided Design

Abstract:

Microwave engineers have been using CAE tools for several decades. Commercial CAE systems for RF, wireless and microwaves are no longer regarded as complete without a variety of design automation capabilities, such as optimization and statistical techniques. Computer-integrated manufacturing, including CAD, CAM, information management and decision support systems, will be a reality facing the design engineer in the next century. Contributing to this environment will be techniques that fall into the broad area of optimization technology, including methods for performance sensitivity analysis, automated postproduction alignment and tuning, fault diagnosis, fault-tolerant design, manufacturing tolerance assignment, yield- and cost-driven design, six-sigma statistical design, design of experiment methods and Taguchi design techniques. In addition, the workshop will focus on implementable methodologies, strategies and software applicable to diverse CAE practices, such as active and passive device, circuit and system design. The workshop will be biased toward the exploitation of physically-based and electromagnetic simulators, including electrical, mechanical and thermal. Possible future developments in integrated CAE tools will be addressed while linking geometry, layout, physical, electromagnetic and process simulations with performance, yield, cost, system specifications, manufacturability and testability in a manner transparent to the designer. Technological and methodological issues will be discussed that are generally closely related. The workshop will feature a wide variety of experienced speakers, including practicing designers, software developers and academic innovators. Theory, implementation and practical discussions will be geared toward a wide range of engineers.

WFE: COMPARATIVE FILTER TECHNOLOGIES FOR COMMUNICATIONS SYSTEMS

Format: Tutorial plus Working Forum

Date & Time: June 12, 1998; 8:00 AM–5:00 PM

Topics and Presenters:

- *Filter Requirements for Communications Systems*, **Chris Radcliffe**, Phase Devices; **Chandra Kudisia**, COM DEV
- *Coaxial & Waveguide Filters for Space & Ground Systems*, **Ralph Levy**, R. Levy Associates; **Alby Williams**, COMSAT
- *Dielectric Filter Technology*, **Toshio Nishikawa**, Murata; **Jerry Fiedziusko**, Space Systems, Loral
- *MIC & MMIC Filters*, **Robert Milson**, Philips Research; **Dan Swanson**, M/A-COM
- *SAW Technology & Applications*, **Clemens Ruppel**, SIEMENS AG; **Robert Peach**, COM DEV
- *Active Filters*, **Chris Rauscher**, NRL
- *Fin Line Technology*, **Yi-Chi Shih**, MM COMM Inc.
- *HTS Filters & Applications*, **Dawei Zhang**, Conductus; **Rafaaf Mansour**, COM DEV
- *Comparison Matrix for Filter Technologies & Wrap-up*, **Dan Swanson**, **Chandra Kudisia**

Organizer: Chandra Kudisia
Dan Swanson

Sponsors: MTT-8, Filters and Passive Components
MTT-18, Microwave Superconductivity

Abstract:

The market for telecommunications services and products fueled by Internet, mobile and multi-media markets has grown spectacularly in this decade and shows no signs of slowing down. All such communications systems, be it cellular, PCS, cable or satellites, require, in increasing quantity, a range of microwave filters and multiplexers with near ideal characteristics to maximize communications capacity and thus lower system costs. To satisfy this demand, industry is coming up with design innovations and improved manufacturing processes to reduce cost and cycle time. This workshop is designed to

compare microwave filter technologies for communications applications. Invited experts will review each major filter technology and map its application either as a baseline or competing technology across the whole spectrum of communications systems. Speakers would be encouraged to address the critical performance parameters in conjunction with the manufacturing technology required to meet the low cost targets and fast delivery times for the emerging markets. This would allow a fair comparison and give audience the chance to compare and share their experience in the implementation of cost-effective filter designs for their systems. It will provide a forum for filter designers and potential customers to agree or disagree on the merits of filter technologies for various communications applications.

WFF: HIGH POWER MMIC AMPLIFIERS

Format: Tutorial and Working Forum

Date & Time: June 12, 1998; 8:00 AM–5:00 PM

Topics & Presenters:

- *Silicon MMIC PAs for Communication Applications*, **Ali Khatibzadeh**, Texas Instruments
- *Solid-State Power Amplifier Developments in Japan*, **Masaaki Kuzuhara**, NEC, Japan
- *InP Devices and MMICs for High-efficiency, High-power Amplifiers*, **Mehran Matloubian**, Hughes Research Labs
- *Flip-chip MESFET MMIC HPAs*, **Thomas Midford**, Hughes Aircraft
- *HPA Linearity Characteristics Required for Applications Involving Digital Modulation*, **Tony Pavio**, Motorola
- *Power Amplifier Requirements for LMDS Applications*, **William Stephens**, Sarnoff
- *Power Device Modeling and Scaling: MMIC HPA Design Methodology*, **Douglas Teeter**, Raytheon

Organizers: Madhu S. Gupta, Florida State University
John Kuno, Quinstar Technologies

Sponsors: MTT-7, Microwave
and Millimeter-wave Solid-state Devices

Abstract:

This workshop is intended for the designers of wireless communication systems and other RF equipment that employs high-power amplifiers. The designers must confront a number of competing technologies for implementing high-power amplification, including MESFETs, pHEMTs and HBTs; silicon, GaAs, InP and recently developed wide-band-gap materials; low-cost, ceramic and flip-chip packaging; a variety of active device operating conditions from class A to class F; and a host of other choices related to bias voltages, power combining, circuit design and heat removal. In addition, different applications impose a variety of requirements on the power amplifiers, in respect of power output, efficiency, noise, linearity, supply voltages, reliability and cost. This workshop will survey the present state of the art in solid-state HPA technology. The attainable performance, results of recent design innovations and application readiness of alternative HPA technologies will be presented. In particular, the HPA requirements arising in communication applications will be discussed in detail.

WFG: NEW DEVELOPMENTS IN TIME DOMAIN METHODS FOR NON-LINEAR DESIGN

Format: Tutorial and Working Forum

Date & Time: June 12, 1998; 8:00 AM–12:00 PM

Presenters:

- **A. Beyer**, Gerhard-Mercator-Universität-GH-Duisburg, Duisburg, Germany
- **C.M. Snowden**, Leeds University, Leeds, UK
- **M. Steer**, NC State University, USA

- **D. Schreurs**, KU Leuven, Heverlee, Belgium
- **J.A.C. Stewart**, Queens University, Belfast, Northern Ireland

Organizers: A. Beyer
C.M. Snowden

Sponsors: MTT-1, Computer-aided Design
MTT-15, Microwave Field Theory

Abstract:

New developments in nonlinear analysis methods solving problems in the time domain can be found in several areas, promising alternatives to the well-established mixed-mode harmonic balance (HB)-based techniques. Since the beginning of the decade, the time-domain approaches have provided efficient solutions that can be used for highly nonlinear subsystems and systems. These methods, however, were slow initially. Even the semiconductor models were not always mature especially regarding their application to the network design combined with integration. These situations created difficulties in applying time-domain methods to describe nonlinear networks. Over the past five years, various new approaches to nonlinear analysis applying novel semiconductor models and software have been introduced and implemented into CAD software packages. This workshop will present discussions by well-known experts in the field about these state-of-the-art developments. Lectures will address modelling, developments in calculation methods and measurements. Inquiries from participants are welcome during the concluding discussion. Attendees are encouraged to bring viewgraphs and explain their points of view.

WFH: NOVEL APPROACHES TO PHOTONIC-ANTENNA INTEGRATION

Format: Tutorial and Working Forum

Date & Time: June 12, 1998; 8:00 AM–12:00 PM

Topics and Presenters:

- *Tutorial Overview*, **Gary Somers**, MIT Lincoln Labs
- *Overview of Planar Antennas and MW/Photonic Applications*, **Tatsuo Itoh**, UCLA
- *Optical Reconfiguration of Antenna Elements and Feeds Using Reactive Control*, **Robert A. York**, UCSB
- *3D, Reconfigurable Photoconducting Antenna Elements for Generating 80 pS Microwave Pulses*, **Steven D. Mittleman**, Rome Labs
- *Electro-optic Development for Airborne Microwave Receiving Systems*, **Michael D. St. John**, California Microwave
- *Integrated Antenna/Photonic Modules for Optical Fiber Microcellular and Picocellular Systems*, **Rod Waterhouse**, Royal Institute of Technology, Melbourne, Australia
- *Reconfigurable Photonically Excited Antenna Elements: RF Measurements for Receive and Transmit Applications*, **Paul Hein**, Raytheon E-Systems

Organizers: Charles Cox
Tatsuo Itoh

Sponsors: MTT-3, Lightwave Technology
MTT-15, Microwave Field Theory

Abstract:

Using photonics in conjunction with antennas is becoming the norm. Typical examples include using an analog fiber-optic link to replace the coaxial cable between a cellular antenna and its base station or using a photonic true time delay unit to steer the beam of a phased array antenna. In these applications, the design of the photonics and antenna proceed to first order independently of each other. However, the real benefit of using photonics with antennas will be realized when the photonics enable the design of an antenna that otherwise would not have been possible using conventional techniques. In this workshop, various novel approaches that integrate photonics into the design of an antenna are explored.

FRIDAY WORKSHOPS

WFI: PRODUCT DEVELOPMENT THROUGH FOUNDRIES

Format: Tutorial and Working Forum

Date & Time: June 12, 1998; 1:00–5:00 PM

Topics and Presenters:

- *Foundry Basics and Microwave/RFIC Foundries*, **Rob Christ**, Triquint
- *Foundry CAD Tools*, **Niranjan Kanaglekar**, Hewlett Packard
- *Foundry Fabrication Technology and Production*, **Bryant Welch**, M/A-COM
- *Foundry Developed Products and Applications*, **Sanje Moghe**, Northrop-Grumman
- *Foundry Economics and Broad-based Foundries*, **Tom Joseph**, TRW
- *Millimeter-wave Foundries*, **Paul Cooper**, Lockheed Martin

Organizers: Leye Aina, Epitaxial Technologies, LLC
Eliot Cohen,
Palisades Institute for Research Services Inc.

Sponsors: MTT-1, Computer-aided Design
MTT-20, Wireless Communications

Abstract:

The rapidly expanding RFIC and wireless telecommunications market requires low cost and effective product development to achieve rapid time-to-market in a constantly evolving business environment. Foundries are one of the approaches used to develop new products for those without a MMIC or RFIC wafer fabrication infrastructure or for those needing to outsource wafer fabrication for increased production throughput. Although considerable information exists in the literature and in conferences on foundry CAD technologies and fabrication processes, very few opportunities exist where these issues as well as the business and application aspects of foundries can be discussed and presented to foundry users in a format that will aid their product development decisions. This workshop has assembled a panel of renowned experts in foundry CAD and process technology, business and foundry applications to present tutorials, interactive panel discussions and demonstrations on GaAs MMIC foundries. The workshop will specifically present information on foundry basics, economics, technologies and applications. A panel discussion session will enable participants and presenters to discuss how these issues interact to result in successful product development. Finally, participants can interact with presenters through demonstrations. The workshop will benefit a wide range of participants, including design engineers, and program and product managers involved in the development of MMIC- and RFIC-based components for the wireless market.

WFJ: ANTENNA TECHNOLOGY FOR PERSONAL WIRELESS COMMUNICATIONS

Format: Tutorial and Short Course

Date & Time: June 12, 1998; 1:00–5:00 PM

Topics and Presenters:

- *Overview – Personal Wireless Communications Systems*, **Roberto J. Acosta**, NASA Lewis Research Center
- *Single Radiators – Types – Trade-off*, **Richard Q. Lee**, NASA Lewis Research Center
- *Advanced Array Antenna Technology*, **John Huang**, NASA Jet Propulsion Laboratory
- *Smart Antennas – Adaptive Control and Digital Beamforming*, **Rainee N. Simons**, NASA Lewis Research Center
NYMA Group

Organizers: Rainee N. Simons
Richard Q. Lee

Sponsor: MTT-20, Wireless Communications

Abstract:

This half-day workshop will provide the participants with a broad overview of antenna technology for personal wireless communications which includes terrestrial, satellite and LANs covering the frequency range of 900 MHz to V-Band. The presentations will focus on, first, global PCS, global systems which include all current and planned filings. Further with the ACTS system as an example, typical link budget requirements for applications, such as direct product distribution, telemedicine and distance learning will be presented. Second, the design and performance of some commonly used single antennas, such as, wire, plate and printed antennas, will be presented. The trade-off of these antennas including radiation characteristics, feeding and fabrication techniques, gain, LP vs. CP, etc. will be discussed. Third, advanced microstrip patch antenna arrays for ground and space applications, such as L-Band Yagi, Ka-Band reflectarray, P-Band four-element wide-band array, L-Band inflatable array and an X-Band inflatable one-meter reflectarray, will be presented. Fourth, adaptive control and digital beamforming techniques will be discussed. Typical applications to mobile satellite communications and LANs will be presented.

ALSO OCCURRING

Friday 12:00–1:00 PM

PACE Panel Session

The IMS '98 will host the first IEEE PACE (Professional Activities Council for Engineers) panel session on Friday, June 12 from noon to 1:00 PM in conjunction with the workshop lunches in the Convention Center. The areas that will be covered are: Employment Benefits, Intellectual Property, Professional Development and Consultant Networks. The speakers are representatives of the IEEE-USA respective committees that deal with the above issues. This panel session is being organized by PACE Chair John Owens.

Baltimore Convention Center

ARFTG CONFERENCE

The Automatic RF Techniques Group (ARFTG) will hold its 51st Conference at the Headquarters Hotel, the Hyatt Regency, on Friday, June 12. This year's meeting will continue ARFTG's leading-edge telecommunications focus with the topic of "Characterization of Spread Spectrum Telecommunications Components and Systems."

Telephone and cable television services providers are converging in their efforts to provide high bandwidth, two-way, full-service networks to homes, schools and businesses. Much of the current infrastructure is based on coaxial cable and many proposed new systems are based either partially or wholly on wireless methodologies. All these systems will require RF components of exceedingly high performance. The characterization of these components and systems, in an automated environment, is central to the 51st Conference. Additional papers will cover topics focused on the ARFTG core theme of automated RF and microwave measurements.

In addition to the Friday conference, registrants are invited to attend the ARFTG/IMS Joint Session on Thursday, June 11. ARFTG registration includes an ARFTG conference digest, banquet luncheon, one-year ARFTG membership and admission to the Thursday ARFTG/IMS Joint Session. See the IMS program for further details on the Joint Session.

For additional information on the ARFTG 51 Conference and the ARFTG/IMS Joint Sessions, contact the Conference Chair or check the ARFTG Web site at <http://www.arftg.org>.

SITE INFORMATION

The 51 ARFTG Conference will be held in the Headquarters Hotel, the Hyatt Regency, on Friday, June 12 from 7:30 AM to 5:00 PM. The Hyatt Hotel is centrally located and connected by air bridge to the Convention Center, the Baltimore Inner Harbor and the other conference hotels. A description of the hotel and a map of the immediate area are included in the registration materials. You may reserve your room by using the Conference Housing Form. For more information about the conference, check the ARFTG Web site at <http://www.arftg.org>.

51ST ARFTG CONFERENCE SCHEDULE

Thursday, June 11	Function	Location
8:00 AM–9:30 AM	ARFTG/IMS Joint Session	Convention Center
3:30 PM–5:15 PM	ARFTG/IMS Joint Session	Convention Center
Friday, June 12	Function	Location
7:30 AM–5:00 PM	ARFTG Conference	Hyatt Regency
7:30 AM–4:00 PM	Exhibition & Poster Session	Hyatt Regency
7:30 AM–8:30 AM	Continental Breakfast	Hyatt Regency
7:30 AM–8:30 AM	Speakers Breakfast	Hyatt Regency
8:30 AM–10:00 AM	Technical Session I	Hyatt Regency
10:00 AM–10:30 AM	Break	Hyatt Regency
10:30 AM–12:00 PM	Technical Session II	Hyatt Regency
12:00 PM–1:00 PM	Lunch	Hyatt Regency
1:00 PM–2:30 PM	Technical Session III	Hyatt Regency
2:30 PM–3:00 PM	Break	Hyatt Regency
3:00 PM–5:00 PM	Technical Session IV	Hyatt Regency

ARFTG STEERING COMMITTEE

Conference Chair John Gregory Burns

Northrop Grumman, M/S 3K13
PO Box 1521
Baltimore, MD 21203
(410) 765-7331
(410) 765-7370 (fax)
burns.john@postal.essd.northgrum.com

Technical Program Chair

Paul Oesterle
Hewlett-Packard
1400 Morris Drive, Suite 300
Wayne, PA 19087-5580
(610) 408-6334
(610) 408-6327 (fax)
paul_oesterle@hp.com

Exhibits Chair/Publicity

D. Michael Fennelly
ATN Microwave Inc.
85 Rangeway Road
North Billerica, MA 01862-2105
(508) 667-4200, ext. 18
(508) 667-8548 (fax)
mfennelly@atn-microwave.com

ARFTG/IMS Joint Session

Dylan F. Williams
NIST
325 Broadway, MC 813.06
Boulder, CO 80303
(303) 497-3138
(303) 497-3970 (fax)
dylan@bldrdoc.gov

Finance

William Pastori
Maury Microwave Corp.
2900 Inland Empire Blvd.
Ontario, CA 91764
(909) 987-4715
(909) 987-1112 (fax)
maury@cyberg8t.com

Digest

Edward Godshalk
Redpoint Microwave Inc.
21325 SW Wildflower Drive
Newburg, OR 97132
(505) 628-5433
(505) 628-5433 (fax)
edg@mxim.com

Registration

Raymond W. Tucker, Jr.
Rome Laboratory ERSS
525 Brooks Road
Griffiss AFB, NY 13441-4505
(315) 330-4217
(315) 330-7083 (fax)
tuckerr@rl.af.mil

Executive Secretary

Henry A. Burger
1008 E. Baseline Road #955
Tempe, AZ 85283-1311
(602) 839-6933
(602) 968-3542 (fax)
h.burger@ieee.org

Executive Committee

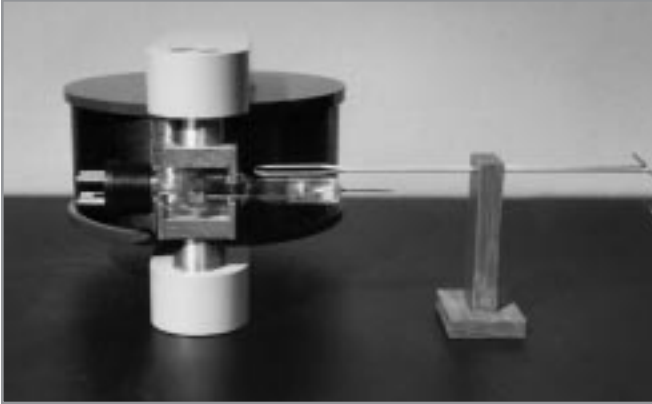
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Redpoint Microwave
Kevin Kerwin
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NIST
Raymond W. Tucker, Membership
Rome Laboratory
Charles Wilker, Nominations/Awards
DuPont
Roger Pollard, ARMMS Liaison
University of Leeds, UK
Henry A. Burger, Executive Secretary
HB Engineers

FRIDAY

PROGRESS THROUGH MICROWAVES

The MTT-S Historical Exhibit will be located in the Baltimore Convention Center Exhibits area, and will be open during the same hours as the Exhibition.

The Historical Exhibit has been expanded this year to include a new magnetron display. Magnetrons dating back to the early 1930s will be shown. Of special interest are the early magnetrons of Ross Kilgore, recipient of this year's Microwave Pioneer Award.



Ross Kilgore Magnetron – 1932

The permanent MTT-S display contains microwave devices of all types, including klystrons, magnetrons, traveling wave tubes, T/R tubes, phase shifters and measuring instruments.

A reading area is available for visitors to browse through some of the hundreds of microwave-related books and other documents. A complete index of books in the MTT-S Historical Collection will be included on the Symposium CD ROM.

There are scheduled viewings of a number of videos showing historical events related to microwaves, including interviews, radar training films and promotional materials.

Several organizations from the Baltimore-Washington area have loaned special displays of important microwave developments such as the proximity fuze, AWACS and Doppler radar.

Operational microwave exhibits are also planned.

Historical Session

A focused session on "Historical Perspectives on Microwave Systems in the Baltimore-Washington Area" will feature papers presented by Gene Strull (Westinghouse), Charles M. Johnson (Johns Hopkins University Radiation Laboratory), Geoffrey Hyde (COMSAT) and Louis Brown (Carnegie Institution of Washington) on Westinghouse, millimeter-wave systems and phased-array radars, space applications and the proximity fuze, respectively.

Historical Electronics Museum



The Historical Electronics Museum is the permanent home of the MTT-S Historical Collection between Symposia. The Museum contains many microwave-related items too large to bring to the Convention Center, including parts of the SCR-270 (Pearl Harbor) radar and a complete operational SCR-584 radar, which was used with the proximity fuze in World War II. It also contains an impressive library of over 7,000 books and 11,000 journals. The Museum is located near Baltimore-Washington International Airport, and is approximately 20 minutes from the Baltimore Convention Center. Scheduled shuttle buses will run to the Museum during the Symposium. Additional information on the Museum can be found on its Web site at <http://www.erols.com/radarmus>, or call (410) 765-2345.

EXHIBITORS

The MTT-S Exhibition is an annual event that has taken place since 1977. It comprises over 375 microwave subassembly component device material instrument and design software suppliers and each year draws approximately 8,000 to 10,000 microwave engineers involved in the design of systems, subsystems, components and devices.

The 1998 Exhibition will be housed in the Baltimore Convention Center. Exhibition hours are Tuesday, June 9 and Wednesday, June 10 from 9:00 AM to 5:00 PM, and Thursday, June 11 from 9:00 AM to 3:00 PM.

Abpac Inc.
Accumet Engineering Corp.
ACE Technologies
Advance Reproductions Corp.
Advanced Noise Technologies
Advanced Technology Group
Aeroflex Laboratories
Aerowave Inc.
AET Associates Inc.
AI Technology Inc.
AIL Systems Inc.
AKON Inc.
Alan Industries Inc.
Alcatel Network Systems
Aliner Connectors Inc.
Alpha Industries
AMCOM Communications Inc.
American Technical Ceramics
Amitron Inc.
Amphenol CNPD
Amplifier Research
Amplifonix Inc.
Anadigics Inc.
Anaren Microwave
Andersen Laboratories Inc.
Anritsu Company
Ansoft Corp.
Antenna Research Associates
API Delevan
Applied Engineering Products
Applied Microwave & Wireless
Applied Specialties Inc.
Arizona State University
Arlon - Materials for Electronics
Artech House
Artwork Conversion Software
ASAP Electronics
Assemblies Inc.
Astrolab Inc.
Atlantic Microwave Corp.
ATN Microwave Inc.
Balo Precision Parts
Belden Wire & Cable Company
Beltran Inc.
Berg Electronics - RF Division
Besser Associates
Boonton Electronics Corp.
Brush Wellman Inc.
C.E. Precision Assemblies Inc.
California Eastern Labs
Carleton University
Cascade Microtech
Celeritek Inc.
Circuits Processing Technology
Cirqon Technologies Corp.
Clearcomm Technologies Inc.
CMR Circuits
Coilcraft Inc.
Coleman Microwave Co.
Colorado Crystal Corporation
Communication Power Corporation
Communications & Power Inds. (TWTPD)
Communications & Power Industries
Communications Products
Communications Systems Design Magazine
Communications Techniques (CTI)
ComNav Engineering Inc.
Compac Development Corp.
Complex
Component Distributors Inc.
Component General Inc.
Comtech PST
Connecting Devices Inc.
Continental Microwave & Tool Co.
Coors Ceramics Co.
Cougar Components
CRC Press Inc.
Crestone Technical Books
CSIRO Australia
CTS Frequency Controls
CTT Inc.
Cuming Corp.
Daden-Anthony Associates Inc.

Daimler-Benz Aerospace AG
Datum Inc. Frequency & Time Systems
DBS Microwave Inc.
Delta Electronics Manufacturing Co.
Delta Microwave
Diablo Industries Inc.
Diablo Industries Inc.
Dielectric Laboratories
DiTom Microwave Inc.
Dorado International Corp.
Dow-Key Microwave Corp.
DuPont Microcircuit & Component Mat
DuPont Superconductivity
Dynaware Inc.
Eagleware Corporation
EE-Evaluation Engineering
EEV Inc.
EiC Corporation
EIP Microwave Inc.
Electromagnetic Technologies Inc.
Elisra Electronic Systems
EMC Technology Inc.
Emerson & Cuming Microwave Products
EMF Systems Inc.
Environmental Stress Systems
Epsilon Lambda Electronics Corp.
Ericsson Inc., RF Power Products
Evered Tube Div., Cole Tubes Ltd.
Film Microelectronics Inc.
Filtran Microcircuits Inc.
Flexco Microwave Inc.
Florida RF Labs Inc.
Focus Microwaves Inc.
Foranne Mfg.
Fotofabrication Corp.
Fox Electronics
Frequency Electronics Inc.
FSY Microwave Inc.
Fujitsu Compound Semiconductor Inc.
Fujitsu Microelectronics Inc.
G.T. Microwave Inc.
Gamma-f Corporation
GBC Materials Corp.
GEC-Marconi Materials Technology
GEL-PAK
General Microwave Corp.
Georgia Institute of Technology
GGB Industries Inc.
GHz Technologies Inc.
Giga-tronics Inc.
Gilbert Engineering Co. Inc.
Charles E. Gillman Company
Glaesteel Industrial Laminates
W.L. Gore & Associates
Harbour Industries
Harris Farinon Components
Haverhill Cable & Mfg. Co.
HEI Inc.
Herley-MDI
Herotek Inc.
Hewlett-Packard Co. (TMO)
Hexaware Inc.
Hitachi Metals America, Ltd.
Hittite Microwave Corp.
HTA Photomask
Hybond Inc.
IFR Systems Inc.
Image Technology
Impellimax Inc.
Infolytica
Inmet Corporation
Institut Fur Mobil - Und Satellite
Insulated Wire Inc.
Integrated Engineering Software
Integrated Microwave Corp.
Integrated Microwave Technologies
Inter-Continental Microwave
International Mfg. Services Inc.
Ion Beam Milling Inc.
Isotemp Research Inc.
ITS Electronics Inc.
ITT GTC
Janco Electronics

Jansen Microwave and GaAs Code
Jay-El/DMT
JCA Technology
JFW Industries Inc.
Johanson Manufacturing
Johanson Technology Inc.
Johns Hopkins University
Johnson Components Inc.
Jye Bao Co. Ltd.
K&L Microwave Inc.
Kalmus
Kaman Instrumentation
Karl Suss America Inc.
KCC Ltd.
KDI/Triangle Electronics Inc.
Kevin Corporation
KMW Inc.
Krytar Inc.
KVG North American Office
KW Microwave Corp.
Kycera America
Kycera Industrial Ceramics Corp.
L. Gordon Packaging
Labtech Limited
Litton Airtron
Litton Electron Devices
Litton Solid State
Lockheed Martin
LogiMetrics Inc.
Lorch Microwave
LPKF CAD/CAM Systems Inc.
M-Wave
M/A-COM
Magnum Microwave
Marki Microwave Inc.
Maryatt Technologies Inc.
Maryland MPC LLC
Maury Microwave Corp.
MCE Companies Inc.
Merrimac Industries
MES MetroElectroSud SAS
Metelics Corporation
Metropole Products Inc.
Mica Microwave Corp.
Micro Lambda Corp.
Micro Metalsmiths Ltd.
Micro Metrics Inc.
Micro Substrates Inc.
Micro-Sub Inc.
Micro-Coax Components Inc.
Micro-Mode Products Inc.
Microelectronics Technology Inc.
Microlab/FXR
Micronetics Wireless
Microphase Corp.
Microsemi
Microsource Inc.
Micross Components Corp.
Microtech Inc.
Microwave Applications Group
Microwave Circuits Inc.
Microwave Comm. & Components Inc.
Microwave Development Company Inc.
Microwave Development Labs Inc.
Microwave Device Technology Corp.
Microwave Engineering Corp.
Microwave Engineering Europe
Microwave Journal
Microwave Product Digest
Microwave Technology Inc.
Microwaves & RF, Wireless Systems
Mid Atlantic RF Systems Inc.
Millitech Corp.
Milmega Ltd.
Mini-Circuits
Mini-Systems Inc.
Mitec Telecom Inc.
MITEQ Inc.
Mitsubishi Electronics America Inc.
Modco Inc.
Modular Components National
Morgan Matroc Ltd., Unilator Div.
Morrow Technologies Corp.
Motorola Semiconductor
MTI - Milliren Technologies Inc.
MTI Technology & Engineering 93 Ltd.

In addition, the Microwave Application and Product Seminars are in their third year serving as a forum for exhibitors to present microwave products, applications services and markets at the level of the microwave practitioner, including design and manufacturing engineers and marketing and management professionals. For a complete schedule and listing of papers, see pages 56 and 57.

Following is a list of exhibiting companies. The list is complete as of press time, but may not include all companies.

MTT-S Historical Exhibit
Murata Electronics
MVS-Microwave & Video Systems Inc.
Narda
National Instruments
Nearson Inc.
Netcom Inc.
NJR Corporation
Noble Publishing
NTK Technical Ceramics
NTT Electronics Corp.
Nurad Technologies Inc.
Oak Frequency Control Group
Olin Aegis
Optiprint AG
Optotek Limited
Ortel Corporation
Oscillatek
Oscom Technologies
P/M Industries
Pacific Coast Technologies
Package Technologies Inc.
Panasonic Industrial Company
Pascall Electronics Ltd.
PCB Engineering Inc.
Peregrine Semiconductor Corp.
Philips Tech./Airpax Protector Grp.
Picosecond Pulse Labs
Piezo Crystal Company
Pole/Zero Corporation
Polese Company
Polyfret RF Devices
Polyflon Company
Precision Tube Company
PSE/ECT, A Division Of Penstock
Pulsar Microwave Corporation
Q-Bit Corporation
QUALCOMM Inc.
Quantum Epitaxial Designs Inc.
Quasar Microwave Technology Ltd.
QUEST Microwave Inc.
Questech Services Corp.
Quinstar Technology Inc.
QWED s.c.
R&K Company Limited
Radian
Raltron Electronics Corp.
Raytheon Microelectronics
Raytheon Systems Company
RDL Inc.
Reactel Inc.
Reeves-Hoffman
RelComm Technologies Inc.
Remcom Inc.
REMEC Inc.
Remtec Inc.
Res-Net Microwave Inc.
Resin Systems Corp.
Retconn
RF Design
RF Industries - RF Neulink Division
RF Micro Devices Inc.
RF Power Components Inc.
RF Prime
Richardson Electronics Ltd.
RJR Polymers Inc.
RLC Electronics Inc.
Robinson Laboratories
Robinson Satellite Communications
Rogers Corporation
Roke Manor Research, Ltd.
H. Rollet & Co. Ltd.
Roos Instruments Inc.
Rosenberger of North America
Sage Laboratories Inc.
Salisbury Engineering Inc.
SaRonix
Schott Electronic Packaging
Scientific Microwave Corp.
Scitec Electronics
Semflex Inc.
Semi-Alloys Co.
Semiconductor Packaging Materials
SGS-Thomson Microelectronics
Siemens Components Inc.
SierraCom

Sigma Systems Corp.
Signal Technology Corp.
Sinclair Manufacturing Co.
SIWARD International Inc.
SMI Electronic Devices America Inc.
Sonnet Software Inc.
Southwest Microwave Inc.
Spectrum Control Inc.
Spinner North America
Sprague-Goodman Electronics Inc.
SRI/Connector Gage Company
SSPA Microwave Corp.
Stanford Microdevices
Stanford Telecom MSD
State Of The Art Inc.
Stellux Microwave Systems Inc.
Stetco Inc.
Stettner GmbH & Co.
Stirling Technology Co.
Storm Products
StratEdge Corp.
Structural Research & Analysis Corp
SV Microwave
Symtx
Synergy Microwave Corp.
T-Tech Inc.
Taconic
TDK / MH&W International Corp.
Tedia Inc.
Tech-Time
Techtrol Cyclonetics Inc.
Tele-Tech Corp.
Teledyne Electronic Technologies
Telefilter - A Vectron Int'l Co.
Telegartner
Test & Measurement World
Tetra Electronic Ind. Ltd.
Texas Instruments Inc.
ThermicEdge Corporation
Thin Film Concepts Inc.
Thin Film Technology Inc.
Thomson Components and Tubes Corp.
Times Microwave Systems
TLC Precision Wafer Technology
Toshiba America Elect. Components
Tracor Aerospace Electronic Sys.
TRAK Microwave Corp.
Trans-Tech
Trilithic Inc.
TriQuint Semiconductor
TRM Inc.
Tronser Inc.
Tru-Connector Corp.
TRW Inc.
TRW Millwave
A.J. Tuck Co.
UltraSource Inc.
United Monolithic Semiconductors
University of California, UCLA
University of Illinois
University of Massachusetts
University of South Florida
University of Utah
University of Virginia
UTE Microwave Inc.
Vari-L Company
Vectron International
Vectron Labs
Vectron Technologies Inc. (VTI)
Victory Industrial Corporation
VITE-Vectron Int'l Tech Express
Voltronics Corp.
A.T. Wall Co.
Watkins Johnson Co.
Wavecom Electronics Inc.
Weinschel Corporation
Weinschel, Bruno Associates
Werlatone Inc.
West Bond Inc.
John Wiley & Sons Inc.
Williams Advanced Materials
Wireless Design & Development
Wireless Systems Design
XL Microwave Inc.
Zeland Software

μAPS are technical, product-oriented seminars presented on the trade show floor adjacent to the exhibition booths.

MESSAGE FROM THE 1998 μAPS CHAIRS

On behalf of the μAPS Program Committee, welcome to the 1998 IMS in Baltimore and to the third Microwave Application & Product Seminars (μAPS). μAPS are technical, practical, product-oriented seminars presented by selected IMS exhibitors.

All sessions are conducted on the trade show floor adjacent to the exhibits. The seminars are free to all technical conference and exhibit attendees. **There is no pre-registration required.** Individual presentations will be 30 minutes in length, with time for questions and answers. The sessions are organized along general topical lines though individual sessions may cover several areas. Please see below for the days and times.

The purpose of the Microwave Application & Product Seminars is to provide technical information and background related to commercially available products of interest to the microwave engineering community, including design, manufacturing, marketing and management professionals. These presentations provide attendees with another means to learn about new products and techniques that can immediately benefit their work.

Ralph W. Bruce Ph.D. and Marjorie Friedman Axler
μAPS Co-Chairs

1998 μAPS SCHEDULE

The 1998 Microwave Application & Product Seminars will be held on Tuesday, Wednesday and Thursday, June 9–11, 1998 in conjunction with the 1998 International Microwave Symposium (IMS) at the Baltimore Convention Center. The series of individual presentations is open to any exhibition or conference attendee.

Tuesday, June 9, 1998

12:00–5:00 PM

Wednesday, June 10, 1998

9:05 AM–5:00 PM

Thursday, June 11, 1998

9:05 AM–3:00 PM

μAPS — MICROWAVE APPLICATION & PRODUCT SEMINARS — TECHNICAL PROGRAM

TUESDAY, JUNE 9, 1998 EXHIBITION FLOOR, BALTIMORE CONVENTION CENTER

Power Measurements in Digital Communications

Steve Reyes, marketing manager, Giga-tronics, San Ramon, CA

12:00–12:30 PM

Characteristics and Accuracy of a Fully Corrected Four-port Vector Network Analyzer

Mike Fennelly, sales and marketing manager, ATN Microwave, North Billerica, MA

12:30–1:00 PM

CDMA Load Pull Measurements with Harmonic Tuning and Harmonic Behavioral Modeling

Mike Fennelly, sales and marketing manager, ATN Microwave, North Billerica, MA

1:00–1:30 PM

Practical Q Measurements for Dielectric Resonators

John Deriso, applications engineer, Trans-Tech Inc., Adamstown, MD

1:30–2:00 PM

RF Device Characterization with a Single Bench Top Instrument

David Vondran, product marketing engineer, Anritsu Co., Morgan Hill, CA

2:00–2:30 PM

New Programmable Tuner for Harmonic Load Pull

Dr. Christos Tsironis, Focus Microwaves, Quebec, Canada

2:30–3:00 PM

Solving Custom Measurement Problems with a Fully Programmable VXI Spectrum Analyzer

Thomas Murphy, product manager, Morrow Technologies, Largo, FL

3:00–3:30 PM

Active Device Characterization/Device Characterization with Automated Tuners

Gary Simpson, engineering section manager, Maury Microwave, Ontario, CA

3:30–4:00 PM

Advances in On-wafer Vector Network Analyzer Calibration Techniques

Eric Strid, CEO, Cascade Microtech Inc., Beaverton, OR

4:00–4:30 PM

The Measurement of Intermodulation Products on Passive Components and Transmission Lines

Bernhard Rosenberger, head, R&D,
Rosenberger HF - Technick GmbH & Co., Tittmoning, Germany

4:30–5:00 PM

Session 1
Session Chair
Ralph W. Bruce
12:00–2:30 PM

Measurement Theory and Techniques

Session 2
Session Chair
Bill Pastore
2:30–5:00 PM

Measurement Theory and Techniques

WEDNESDAY, JUNE 10, 1998
EXHIBITION FLOOR, BALTIMORE CONVENTION CENTER

Fast EM Simulation Technologies for Wireless Component and System Design	9:05–9:30 AM
Dr. Lawrence I. Williams, Ansoft, Fullerton, CA	
Fast Harmonic Balance Enables Multi-tone Analysis of Large Nonlinear Circuits	9:30–10:00 AM
Jason Gerber, Ansoft, Elmwood Park, NJ	
Piecewise Circuit Analysis Using Sonnet <i>emgen</i> for Netlist Driven EM Analysis	10:00–10:30 AM
Shawn Carpenter, VP marketing and sales, Sonnet Software Inc., Liverpool, NY	
NeuroModeler: Neural Network for Microwaves	10:30–11:00 AM
Dr. Q.J. Zhang, Carleton University, Ottawa, Ontario, Canada	
Windows Based 3D Electromagnetic Simulation Software	11:00–11:30 AM
John Roth, president, Zeland Software, Aptos, CA	
Full Wave Finite Element 3D Software for Microwaves	11:30 AM–12:00 PM
Robert Rohonczy, marketing manager, Infolytica Corp., Montreal, Quebec, Canada	
Effective Thermal Testing	12:00–12:30 PM
David Russell, sales manager, Sigma Systems Corp., San Diego, CA	
Advanced Packaging of 3V MMICs for Wireless Applications	12:30–1:00 PM
Masayaki Kawasaki, manager, New Japan Radio Co. Ltd.	
Specifying Coaxial Cable Assemblies in Coherent Systems	1:00–1:30 PM
Henry Richards, VP marketing, C.E. Precision Inc., Chandler, AZ	
Ultra Small Isolator for Mobile Phones	1:30–2:00 PM
Amol Kirtikar, RF engineer, Hitachi Metals Ltd., Tottori, Japan	
Ku-band Reflector Antenna	2:00–2:30 PM
Dr. Ming Hui Chen, president, Victory Industrial Corp., Taipei, Taiwan, R.O.C.	
A Primer on SAW Oscillator Technology: A "Chalk Talk"	2:30–3:00 PM
Lewis E. Springer, president & CEO, and Robert P. Bernardo, RF & microwave engineering manager, Andersen Labs, Bloomfield, CT	
Advances in Crystal and Crystal Oscillator Technology	3:00–3:30 PM
Kory B. Stone, sales & marketing manager, Reeves-Hoffman, Carlisle, PA	
Understanding Switch Filter Assemblies	3:30–4:00 PM
John G. Filakowski, director of engineering, Microphase Corp., Norwalk, CT	
Fractional-n PLL ASIC Review	4:00–4:30 PM
Bar-Giora Goldberg, executive VP, Sciteq Communications Inc., San Diego, CA	
Low Cost/Low Profile Passive Components	4:30–5:00 PM
Paul Vinsand, Mini-Circuits Inc., Brooklyn, NY	

Session 3
Session Chair
Robert Rohonczy
9:05 AM–1:00 PM

Modeling, CAD and Packaging

Session 4
Session Chair
Henry Richards
1:00–5:00 PM

Components

THURSDAY, JUNE 11, 1998
EXHIBITION FLOOR, BALTIMORE CONVENTION CENTER

Flexipower™: Integration of RFIC Solutions on a Single Chip	9:05–9:30 AM
Dr. Ronald E. Reedy, Peregrine Semiconductor Corp., San Diego, CA	
TLC's New Ka-band to W-band Millimeter-wave MMIC Products and Services	9:30–10:00 AM
Timothy Childs, marketing director, TLC Precision Wafer Technology Inc., Minneapolis, MN	
Practical Applications of MMIC Components	10:00–10:30 AM
Norm Hildreth, engineering sales manager, Hittite Microwave Corp., Woburn, MA	
Low Cost HBT and HEMT GaAs MMICs for Commercial Telecommunications	10:30–11:00 AM
Bob Pinato, marketing manager, GaAs Telecom Products, TRW, Redondo Beach, CA	
Millimeter-wave Communications: Markets and Technologies	11:00–11:30 AM
Holgar H. Meiner, Daimler-Benz Aerospace, Ulm, Germany	
Method to Extract SPICE Models for RF Power MOSFETS	11:30 AM–12:00 PM
S.K. Leong, Polyfet RF Devices, Camarillo, CA	
RF Integrated Circuits and Modules for Cellular and PCS Telephone Applications	12:00–12:30 PM
Shamsur Mazumder and Raymond S. Pengelly, Raytheon Microelectronics, Andover, MA	
Design Trade-offs for the Selection of RFICs in Wireless Applications	12:30–1:00 PM
Dr. Larry Wang, EiC Corp., Fremont, CA	
Power Amplifier Design Seminar	1:00–1:30 pm
Al Sweet, Hexawave Inc., Alameda, CA	
Adaptive High-efficiency RF Power Amplifier for Portable Applications	1:30–2:00 PM
Jonathan King, applications engineering manager, QUALCOMM Inc., San Diego, CA	
Detector LVAs for Modern EW Systems	2:00–2:30 PM
Stephen R. Capasso, design engineer, Microphase Corp., Norwalk, CT	
Biased Temperature Compensation Attenuators	2:30–3:00 PM
Joseph Mazzochette, VP engineering, EMC Technologies Inc., Cherry Hill, NJ	

Session 5
Session Chair
Timothy Childs
9:05 AM–12:00 PM

Monolithics, Millimeter Waves and Applications

Session 6
Session Chair
Al Sweet
12:00–3:00 PM

Wireless Communications and Amplifiers

1998 MTT-S AWARDS

MICROWAVE CAREER AWARD

The Microwave Career Award is the highest honor bestowed by the MTT Society. It recognizes an individual for a lifetime career of meritorious service and technical excellence in the field.

In 1998, our honored recipient is Harold Sobol.

Citation:

"FOR A CAREER OF LEADERSHIP, MERITORIOUS ACHIEVEMENTS, CREATIVITY AND OUTSTANDING CONTRIBUTIONS IN THE FIELD OF MICROWAVE THEORY AND TECHNIQUES."

PIONEER AWARD

The Pioneer Award recognizes contributions that have had a major impact on the field and have stood the test of time. The basis for nomination is an archival paper in the field of interest to MTT-S, published at least 20 years prior to the year of the award.

The recipient this year is G. Ross Kilgore.

Citation:

"FOR PIONEERING WORK IN 1931-1934 ON INTERNAL CIRCUIT MAGNETRON OSCILLATOR TUBES AND THE GENERATION OF 9 CM WAVES."

MICROWAVE APPLICATION AWARD

The Microwave Application Award is presented aperiodically to individuals for an outstanding application of microwave theory and techniques. The eligibility requirements are creation of a new device, component or technique, or a novel use of components, or both.

This year's recipient are Randall E. Lehmann and David D. Heston.

Citation:

"FOR THE INVENTION AND APPLICATION OF SERIES INDUCTIVE FEEDBACK TO MONOLITHIC LOW-NOISE AMPLIFIERS."

MICROWAVE PRIZE

The Microwave Prize is awarded annually to the author or authors of a paper published in the *IEEE Transactions on Microwave Theory and Tech-*

niques, or any other IEEE publication, that is judged to be the most significant contribution in the field of interest to the Society in the calendar year preceding that in which the selection is made.

The 1998 Microwave Prize is awarded to Tapani N rhi, for the paper entitled "Frequency-domain Analysis of Strongly Nonlinear Circuits Using a Consistent Large-signal Model," *IEEE Transactions on Microwave Theory and Techniques*, Vol. 44, No. 2, February 1996, pp. 182-192.

DISTINGUISHED SERVICE AWARD

The Distinguished Service Award honors an individual who has given outstanding service over a period of many years for the benefit and advancement of the MTT Society.

This year's honoree is Martin V. Schneider.

Citation:

"FOR HIS OUTSTANDING AND DEDICATED SERVICE TO THE SOCIETY."

DISTINGUISHED EDUCATOR AWARD

This award was inspired by the untimely death of Professor F.J. Rosenbaum (1937-1992), an outstanding teacher of microwave science and a dedicated MTT-S AdCom member/contributor. The award is given to a distinguished educator recognized, in general, by an academic career coupled to many years of service to the microwave profession.

This year's honoree is Robert J. Trew.

Citation:

"FOR OUTSTANDING ACHIEVEMENTS AS AN EDUCATOR, MENTOR AND ROLE MODEL OF MICROWAVE ENGINEERS AND ENGINEERING STUDENTS."

N. WALTER COX AWARD

The N. Walter Cox Award has been established in recognition of the qualities of N. Walter Cox and his service to the MTT Society prior to his untimely death in 1988. It is given aperiodically to a Society volunteer whose efforts on behalf of MTT-S best exemplify his spirit and dedication.

This year's recipient is Roger Kaul.

Citation:

"FOR EXEMPLARY SERVICE, GIVEN IN A SPIRIT OF SELFLESS DEDICATION AND COOPERATION."

1998 IEEE FELLOW AWARDS

Six MTT-S members who were evaluated by the Society were elected to the grade of Fellow, effective 1 January 1998. The grade of Fellow is conferred in recognition of unusual professional distinction. It is awarded at the initiative of the IEEE Board of Directors after a rigorous nomination and evaluation process. Individuals receiving this distinction have demonstrated extraordinary contributions to one or more fields of electrical engineering, electronics, computer engineering and related sciences. This grade is not conferred automatically on nomination; only a fraction of those nominated are honored by elevation to the grade of IEEE Fellow.

NAME	CITATION
Masami Akaike	<i>For contributions to nonlinear analysis and design of millimeter-wave and microwave solid-state devices.</i>
Masahiro Hashimoto	<i>For contributions to electromagnetic theory, especially for guided-wave optics.</i>
Mohammad Madihian	<i>For contribution to the design and development of microwave as well as millimeter-wave solid state monolithic integrated circuits for personal computing and wireless networking systems.</i>
Michel Sobhy Nakhla	<i>For contributions to the development of advanced CAD techniques for microwave circuits and high-speed interconnects.</i>
Denis Conrad Webb	<i>For leadership in the development and application of microwave ferrite devices.</i>
Karl Sigfrid Yngvesson	<i>For contributions to the development of millimeter-wave devices and systems.</i>

The following 12 new Fellows are also MTT-S members, but were evaluated by other IEEE Societies.

NAME	CITATION
April Susan Brown	<i>For contributions to the development of lattice-matched and pseudomorphic high electron mobility field effect transistors.</i>

Young-Kai Chen	<i>For contributions to ultra-short pulse generation using semiconductor lasers, integrated laser modulators and high frequency InP HBTs.</i>
Geza Dienes	<i>For contributions to the design and development of broadcast antenna systems.</i>
Barry K. Gilbert	<i>For developments of improved electronic packaging for high performance gallium arsenide integrated circuits.</i>
Ahmed Abdelwahed Kighk	<i>For contributions to the modeling of symmetrical antennas and scatterers.</i>
Edward Francis Kuester	<i>For contributions to electromagnetic wave theory and applied mathematics, especially to microstrip structures propagating along open waveguide structures and electromagnetic compatibility.</i>
John Litva	<i>For contributions to electromagnetic modeling, microstrip antennas, beamforming and propagation, as well as for technical leadership in the areas of low-angle radar tracking, microwaves and signal processing.</i>
Asad M. Madni	<i>For contributions to the design and development of instrumentation for electronic warfare center.</i>
Stuart Owen Nelson	<i>For contributions to the measurement of radio frequency and microwave dielectric properties of agricultural materials.</i>
Istvan Novak	<i>For contributions to the theory and practice of radio frequency monitoring techniques, and to the measurement and simulation of high-speed digital systems.</i>
Korada Reau Umashankar	<i>For contributions to the development of computational electromagnetics in the area of integral equation methods and finite-difference time-domain techniques.</i>
William J. Wilson	<i>For contributions to microwave radiometry for radio astronomy and remote sensing applications.</i>

Mohamed Abouzahra	Bernard Geller	Roger Marks	Yi-Chi Shih
Stephen Adam	Jitendra Goel	Mehran Matloubian	Bernard Sigmon
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Ali Atia	Ramesh Gupta	Jozef Modelski	Richard Sparks
Inder Bahl	Ron Ham	Mauro Mongiardo	Barry Spielman
Shyam Bajpac	Victor Fouad Hanna	Bob Moore	Peter Staecker
John Bandler	Mike Harris	Amir Mortazawi	Michael Steer
Rajeev Bansal	James Harvey	Vijay Nair	Steven Stitzer
Zaher Bardai	John Heaton	Krishna Naishadham	Eric Strid
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Marvin Cohn	George Jerinic	Aryeh Platzker	Denis Webb
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Carol Gee	Raafat Mansour	Arvind Sharma	

Chairman**Steven Stitzer**

Northrop Grumman
PO Box 1521, MS 3T15
Baltimore, MD 21203
T (410) 765-7348 F (410) 993-7747
s.stitzer@ieee.org

Vice Chair**Roger Kaul**

Army Research Lab
AMSRL-SE-RE,
2800 Powder Mill Rd.
Adelphi, MD 20783
T (301) 394-4775 F (301) 394-2525
rkaul@arl.mil

Technical Program**Ed Niehenke, Chair**

Niehenke Consulting
5829 Bellanca Drive
Elkridge, MD 21075
T (410) 796-5866 F (410) 796-5829
e.niehenke@ieee.org

Denis Webb, Vice Chair

Naval Research Lab
Code 6850
Washington, DC 20375
T (202) 767-3312 F (202) 767-0455
d.webb@ieee.org

Special Sessions**Bob Moore**

1243 Balfour Drive
Arnold, MD 21012
T (410) 768-5233 F (410) 768-5321

Mike Frankel

Naval Research Lab
Code 5672
Washington, DC 20375
T (202) 404-8718 F (202) 404-8645
frankel@nrl.navy.mil

Workshops**Lee Phelps**

M/A-COM
22300 Comsat Drive
Clarksburg, MD 20871
T (301) 428-4569 F (301) 540-8512
phelpsl@macom.com

Jeff Pond

Naval Research Lab
Code 6851
4555 Overlook Avenue SW
Washington, DC 20375
T (202) 767-2862 F (202) 767-0455
pond@chrisco.nrl.navy.mil

Pete Stenger

Northrop Grumman
PO Box 1521, MS 3K11
Baltimore, MD 21203
T (410) 993-7949 F (410) 765-2116
stenger.pa@postal.northgrum.com

Tim Lee

M/A-COM
22300 Comsat Drive
Clarksburg, MD 20871
T (301) 428-4178 F (301) 540-8512
leet@macom.com

Panel Sessions**Shyam Bajpai**

NOAA/NESDIS
FB4 Room 3010
Washington, DC 20233-9909
T (301) 457-5225 F (301) 457-5722
sbajpai@nesdis.noaa.gov

Saurabh Dalal

Raytheon Systems
7700 Arlington Blvd.
Falls Church, VA 22042
T (703) 560-5000 x 1-2844
s.dalal@ieee.org

Interactive Forum**Harvey Newman**

Naval Research Lab – Code 6851
Washington, DC 20375
T (202) 767-3008 F (202) 767-0455
newman@estd.nrl.navy.mil

Dan Buck

916 Timber Ridge Drive
Hanover, MD 21076
T (410) 761-6966
104576.2422@compuserve.com

Larry Dickens

Northrop Grumman
PO Box 1521, MS 3K11
Baltimore, MD 21203
T (410) 765-2075 F (410) 993-7432
ldickens@clark.net

Student Paper Contest**Gregory Wilkins**

Morgan State University
Clarence M. Mitchell Jr. Bldg.
5200 Perring Parkway
Baltimore, MD 21239-4098
T (410) 319-3153 F (410) 319-3843
gwilkins@eng.morgan.edu

Peter Herczfeld

Drexel University
3141 Chestnut St.
Commonwealth, Rm 517 ECE Dept.
Philadelphia, PA 19104
T (215) 895-2256 F (215) 895-4968
herczfeld@ece.drexel.edu

Ron Hooker

NOAA
8144 Harvest Court
Severn, MD 21144
T (301) 286-3216 F (301) 286-9777
ronald.hooker@gsfc.nasa.gov

Marge Axler

Marjar Design Systems
PO Box 71152
Chevy Chase, MD 20813-1152
T (202) 333-5383 F (202) 333-5383

Digest Editor**Raymond Meixner**

Seta/TRW/RMS
16524 Redland Rd.
Rockville, MD 20855
T (202) 651-2190 F (202) 484-4460
raymond.meixner@faa.dot.gov

John Cruz

TRACOR Systems Technologies Inc.
1601 Research Blvd.
Rockville, MD 20850
T (301) 838-6479 F (301) 838-6427
cruzj@tst.tracor.com

CD-ROM Editor**Eric Funk**

University of Maryland
Dept. of Elect. Eng.
College Park, MD 20742
T (301) 405-1233/4872
F (301) 314-9281
yag@eng.umd.edu

Transaction Guest Editor**Roger Westgate**

Johns Hopkins University
Whiting School of Engineering
3400 Charles Street, NEB 120
Baltimore, MD 21218
T (410) 516-8350 F (410) 516-8627
westgate@jhu.edu

Ramesh Gupta

COMSAT
22300 Comsat Drive
Clarksburg, MD 20871
T (301) 428-4141 F (301) 540-8208
ramesh.gupta@comsat.com

Local Arrangements**Dave Sheehan**

Mid-Atlantic Microwave
3537 Spencerville Road
Burtonsville, MD 20866
T (301) 421-0266 F (301) 421-9140
71022.1770@compuserve.com

Local Arrangements-Housing**Frank Halgas**

Micro Lambda
4513 Mountain Road
Pasadena, MD 21122
T (410) 437-7633 F (410) 437-9786
frankhalgas@prodigy.net

Signs Manager**John Sebastian**

Connected Resources
3720 Chesmont Avenue
Baltimore, MD 21206
T (410) 944-2800 F (410) 944-5999
jsebastian
@connectedresources.com

Registration**Gus Bontzos**

Stanford Telecom
141 National Business Parkway
Annapolis Junction, MD 20701
T (301) 497-9900 F (301) 497-0207
gus.bontzos@stelhq.com

Jim Degenford

Northrop Grumman
PO Box 1521, MS 3K13
Baltimore, MD 21203
T (410) 765-7334 F (410) 765-7370
jdegenford
@loyolanet.campus.mci.net

Finance**Fred Kuss**

Northrop Grumman
7076 Ducketts Lane, #303
Elkridge, MD 21075
T (410) 993-6277 F (410) 765-2116
kuss
@mpd200.md.essd.northgrum.com

John Upshur

COMSAT
22300 Comsat Drive
Clarksburg, MD 20871
T (301) 428-4400 F (301) 540-8208
john.upshur@comsat.com

Publicity/Program**Nathalie Gallet**

Antenna Research
11317 Frederick Rd.
Beltsville, MD 20705
T (301) 937-8888 F (301) 937-2796
emc@ara-inc.com

Secretary/Protocol**Suman Patel**

Northrop Grumman
PO Box 1521, MS 3T15
Baltimore, MD 21203
T (410) 765-7368 F (410) 993-7747
patel.s.d
@postal.essd.northgrum.com

RFIC Liaison**Ho-Chung Huang**

Amcom Communications
PO Box 179
22300 Comsat Drive
Clarksburg, MD 20871
T (301) 353-8400 F (301) 353-8401
hohuang@aol.com

ARFTG Liaison**Greg Burns**

PO Box 1521, MS 3K13
Baltimore, MD 21203
T (410) 765-7331 F (301) 890-0486
burns.john
@postal.essd.northgrum.com

Industry Relations/Microwave Application Product Seminars**Ralph W. Bruce**

RWBruce Associates Inc.
1594 Chickasaw Rd.
Arnold, MD 21012-2526
T (410) 757-3333
rwbruce@the-hermes.net

Historical Exhibit**Ted Nelson**

3992 Old Columbia Pike
Ellicott City, MD 21043
T (410) 465-6726 F (410) 465-1378
sales@nelrep.com

Jeff Kruth

K-MEC
4862 Montgomery Rd.
Ellicott City, MD 21043
T (410) 461-5544 F (410) 461-5545
kmec@aol.com

Guest Program**Betty Niehenke**

5829 Bellanca Drive
Elkridge, MD 21075
T (410) 796-5866 F (410) 796-5829

Sally Morse

10222 Camelford Court
Ellicott City, MD 21042
(410) 461-5821

Awards Banquet**Jon Moellers**

Northrop Grumman
PO Box 746, MS 55
Baltimore, MD 21203
T (410) 993-6774 F (410) 993-7432
moellers.j.a
@postal.essd.northgrum.com

University Liaison**Kawthar Zaki**

University of Maryland
Electr. Eng., A.V. Williams
College Park, MD 20742
T (301) 405-3674 F (301) 314-9281
zaki@eng.umd.edu

TPC/Publications Support**Larry Whicker**

LRW Associates
PO Box 2530
Mathews, NC 28105
T (704) 841-1915
Lrwassoc@aol.com

Exhibition**Harlan Howe, Jr.****Howard Ellowitz**

Horizon House Publications
685 Canton Street
Norwood, MA 02062
T (781) 769-9750 F (781) 769-5037

Program Publication**Amy Norcross**

Horizon House Publications
685 Canton Street
Norwood, MA 02062
T (781) 769-9750 F (781) 769-5037
anorcross@mwjournal.com

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R.W. Sudbury	J.K. McKinney	J.S. Kenney
G.R. Thoren	M.J. Schindler	R. Sorrentino
R.J. Trew	K.R. Varian	M.B. Steer

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1996	John W. Wassel
1995	Eliot D. Cohen

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MTT-S SYMPOSIA FUTURE LOCATIONS**1999 — ANAHEIM, CA — June 13–18, 1999****Chairman**

Robert Eisenhart
Eisenhart & Associates
Tel (818) 716-1995
Fax (818) 713-1161
r.l.eisenhart@ieee.org

Vice Chairman

John Horton
TRW
Tel (310) 813-1156
Fax (310) 813-3268
j.horton@ieee.org

Technical Program Chair

John H. Kuno
QuinStar Technologies, Inc.
Tel (310) 320-1111
Fax (310) 320-9135
quinstar@quinstar.com

Technical Program Vice-Chair

Madhu Gupta
Florida State University
Tel (860) 467-6450
Fax (860) 487-6479
m.gupta@ieee.org

Local Arrangements

J.K. McKinney
Dura Electronics Sales
Tel (909) 612-1044
Fax (909) 612-1047
j.mckinney@iee.org

Registration

Phil Arnold
Hewlett Packard
Tel (818) 779-2307
Fax (818) 779-2350
phil_arnold@hp.com

2000—BOSTON, MA**June 11–16, 2000****Chairman**

Glenn R. Thoren
Lockheed/Sanders
Tel (603) 885-2988

2001—PHOENIX, AZ**May 20–25, 2001****Chairman**

J. Mike Golio
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Tel (319) 295-3926

2002—SEATTLE, WA**June 3–7, 2002****Chairman**

Donn Harvey
Metawave Communications Corp.
Tel (206) 869-7499, ext. 276

2003—PHILADELPHIA, PA**June 8–13, 2003****Chairman**

Richard Snyder
RS Microwave
Tel (201) 492-1207

2004—FORT FORTH, TX**June 7–12, 2004****Chairman**

Karl Varian
Texas Instruments
Tel (972) 995-3783

2005—LONG BEACH, CA**June 12–17, 2005****Chairman**

Charlie Jackson
TRW
Tel (310) 812-0283

GUEST PROGRAM

Hospitality Suite: A hospitality suite will be provided at the Hyatt Regency Hotel Monday through Thursday from 7:00 AM to 5:00 PM for guests of attendees. A continental breakfast will be served in the morning, and snacks with beverages will be served all day. Knowledgeable tour guides and hostesses will be on hand to answer questions on the highlights and restaurants of Baltimore, plus maps and brochures will be available. In addition, information and gatherings for the tours will be held in the hospitality suite.

Tours: Tours planned for the 1998 IEEE MTT-S International Microwave Symposium will include transportation on a comfortable coach and a delicious lunch. Departures will be from the Charles Street entrance of the Hyatt Regency Hotel. Tickets will be included in the registration packets of those who have pre-registered for the Symposium. It is advisable to make reservations as part of the advanced registration as all tours are sold on a first-come, first-served basis.

Tuesday, June 9
9:00 AM–4:00 PM

**Baltimore: Stars and Stripes
and Special Sights**
Cost: \$50 per person

Join us for a memorable tour of some of the highlights of Baltimore. Our visit will include stops at the Cathedral of Mary Our Queen; Lexington Market, the oldest public market in the nation;

and the gravesite of Edgar Allan Poe. We will also take in the Johns Hopkins Hospital and Mt. Vernon Place, site of the Peabody Conservatory. After lunch at the world-famous Haussner's, we will tour Ft. McHenry.

Wednesday, June 10
9:00 AM–3:00 PM

**Annapolis:
A Town of Three Centuries**
Cost: \$50 per person

After a 50-minute drive to Annapolis, we will visit the Maryland State House, St. John College and the US Naval Academy. Luncheon will be served at one of Annapolis' historic inns. We will end the tour with browsing in the quaint shops that line the dock of this historic port. Please wear comfortable walking shoes.

Thursday, June 11
8:00 AM–4:00 PM

**A Day in Washington, DC,
Our Nation's Capital**
Cost: \$50 per person

Our driving tour of Washington, narrated by an informed guide, will visit some of our national treasures, including the Capitol, Library of Congress and Washington Monument. Relax and enjoy lunch at a well-known restaurant overlooking the Potomac. We will also see the Washington, Lincoln, Vietnam, Korean, Women in Combat and Franklin D. Roosevelt memorials.

GENERAL INFORMATION

Information Booth: Pamphlets and information on the Baltimore/Washington area will be available at a booth located in the Pratt Street lobby of the convention center. This booth will be manned by the Baltimore Area Convention and Visitor Association.

Message Center: A message center will be located in the registration area of the Convention Center. The telephone number is (410) 649-7360. This telephone is available for brief incoming voice messages only.

IEEE/MTT-S Memberships: An IEEE/MTT-S membership booth will be located in the registration area. Those who apply for membership on site will be eligible for the discounted member rates on registration fees. IEEE members (or on-site applicants) who register for the full symposium and have not been an MTT-S member in the past year will be offered a free one year

basic MTT-S membership, which will include admission to the MTT-S members' breakfasts.

Drinks and Refreshments: Free coffee and soft drinks will be available during mid-morning and mid-afternoon breaks in the refreshment areas in the exhibition hall.

Smoking: Smoking is not permitted in the Baltimore Convention Center.

Recruiting: Businesses do not send their personnel to the IMS to be recruited by other businesses. To ensure that these meetings continue in the future, IEEE policy insists that recruiting does not occur at the Symposium.

Recording of Technical Presentations: The recording of technical presentation by video or audio recorders or cameras is not allowed without the permission of the speaker in advance and notification of the session organizer.

ADDITIONAL MEETINGS

Saturday, June 6	5:30 PM–6:30 PM	AdCom Reception	Hyatt Regency
	6:30 PM–8:00 PM	AdCom Dinner	Hyatt Regency, Baltimore Room
	8:00 PM–11:00 PM	AdCom Meeting	Hyatt Regency, Chesapeake Room
Sunday, June 7	7:00 AM–8:00 AM	AdCom Breakfast	Hyatt Regency, Baltimore Room
	8:00 AM–5:00 PM	AdCom Meeting	Hyatt Regency, Chesapeake Room
	7:00 PM–10:00 PM	RFIC Reception	Hyatt Regency
	7:00 AM–8:00 AM	Workshop Continental Breakfast	BCC Ballroom
Monday, June 8	7:00 AM–8:00 AM	RFIC Continental Breakfast	BCC Ballroom
	7:00 AM–5:00 PM	IMS Speakers' Preparation	BCC Room 313
	6:00 PM–10:00 AM	Microwave Journal Reception	Science Center
Tuesday, June 9	7:00 AM–8:00 AM	IMS Speakers' & MTT-S Members' Breakfast	BCC Ballroom
	7:00 AM–5:00 PM	IMS Speakers' Preparation	BCC Room 313
	5:30 PM–6:30 PM	Chapter Chair Meeting	BCC
	6:30 PM–9:00 PM	Crab Feast	Oriole Park, Camden Yards
Wednesday, June 10	7:00 AM–8:00 AM	IMS Speakers' and MTT-S Members' Breakfast	BCC Ballroom
	7:00 AM–5:00 PM	IMS Speakers' Preparation	BCC Room 313
	12:00 PM–1:15 PM	1999 IMS TPC Lunch	BCC Ballroom
	6:00 PM–7:30 PM	Industry-hosted Cocktail Reception	Hyatt Regency
	7:30 PM–10:00 PM	MTT-S Awards Banquet	Hyatt Regency
Thursday, June 11	7:00 AM–8:00 AM	IMS Speakers' & MTT-S Members' Breakfast	BCC Ballroom
	7:00 AM–5:00 PM	IMS Speakers' Preparation	BCC Room 313
	12:00 PM–1:10 PM	1998/1999 IMS Steering Committee Lunch	BCC Room 337
	12:00 PM–1:15 PM	RF and Microwave Education Forum	BCC Room 343
Friday, June 12	12:00 PM–1:00 PM	IEEE PACE Forum	BCC

TRAVEL TO BALTIMORE

Air Travel: United Airlines is the official airline of IMS '98. Call United's Specialized Meeting Reservations Center at 800-521-4041 and use **Meeting ID Number 570HZ** to receive an additional five percent off the lowest applicable fare, including First Class, or 10 percent off midweek coach fares purchased seven days in advance. An additional five percent discount can be obtained if seats are purchased at least 60 days in advance of travel. These discounts apply for travel in the US and Canada, and can be used on United Shuttle and United Express. Reservationists are on duty seven days a week from 7:00 AM to 12 midnight EST.

Baltimore-Washington International (BWI) Airport: BWI is the closest airport to the Symposium. From BWI, taxis cost approximately \$20 one way. Up to four people may share a taxi. Taxis take about 20 to 30 minutes each way. If two or more people are traveling together, taxi service cost is generally cheaper than the airport shuttle. Taxis are also more time efficient.

SuperShuttle (410-859-0800) operates from BWI to the major downtown hotels. SuperShuttle leaves BWI at 15 and 45 minutes after the hour beginning at 5:45 AM EDT and ending at 11:15 PM EDT. The shuttle takes 30 to 40 minutes one way. Schedules to return to BWI will be available at your hotel. The SuperShuttle tickets currently cost \$11 one way and \$18 roundtrip. To take the shuttle from the airport, purchase a ticket at the SuperShuttle desk located on the lower level of the airport near the domestic flight baggage claim area. Advance reservations are not accepted.

Reagan National and Dulles Airports: The Baltimore Airport Shuttle (410-821-5387, 800-287-4227 in the US) is an independent company offering service by reservation only to and from both Reagan National and Dulles airports. You must call in advance (they suggest at least 24 hours) and leave a credit card number to secure a reservation for pickup time. From National, the cost is \$65 for the first passenger, \$10 for each additional individual in the party (one way). From Dulles, the cost is \$75 for the first passenger, \$10 for each additional individual in the party (one way).

Rail Transportation: The Mass Transit Administration (MTA) operates a light rail service from BWI airport to the Convention Center. Currently, the service operates approximately every 35 minutes from 5:06 AM EDT (10:46 AM EDT on Sundays) to 12:22 AM EDT (8:24 PM EDT on Sundays). Transit time from BWI to the Convention Center stop is about 30 minutes. Purchase your ticket using the machine at the entrance to the BWI stop located at the western end of the international terminal (to your far right as you exit the terminal). Current fare is \$1.35 one way and no advance reservation is accepted. No baggage handling is available for this service. Additional information is available from 410-539-5000 or 800-543-9809.

Amtrak passengers should detrain at Penn Station in Baltimore and take a taxi to their final destination.

Passengers using Maryland Rail Commuter (MARC) service along the Penn line should detrain at Penn Station in Baltimore and take local transportation. MARC service along the Camden line operates from the Camden Yard Station (near the Convention Center) to Washington, DC's Union Station. For additional information, call 410-539-5000 or 800-543-9809.

Driving: From the south follow the Baltimore-Washington Parkway (MD 295) to Russell St. Take Russell St. past Oriole Park at Camden Yard and turn right onto Pratt St. Travel three blocks to the Convention Center. Or take I-95 or I-395 and follow signs to the Inner Harbor.

From the north follow I-95 through the Ft. McHenry Tunnel to I-395 and follow the signs to the Inner Harbor. An additional

route from the north is to follow I-83 to Fayette St. (Exit 1). Turn right. Travel approximately 10 blocks to Howard St. Turn left and travel five blocks to Pratt St. and the Convention Center.

Rental Car: Avis and Alamo rental car companies will offer discounts of 10 percent off the applicable rates when reservations are made in conjunction with United Airlines air travel reservations.

LOCAL

Weather: The weather in Baltimore's Inner Harbor area in June has an average high temperature of 83°F (28°C) and an average low temperature of 62°F (17°C). On the average, measurable rainfall can be expected on one out of three days in June. Also note that Baltimore can be very humid at this time of year, so plan to bring loose clothing that "breathes."

Time: Baltimore operates on Eastern Daylight Savings Time (EDST) during June. EDST is four hours behind Greenwich Mean Time (GMT or Z).

Parking: Parking is not available at the Convention Center. Hotel- and commercial-lot parking rates are \$10 to \$20 per day.

Attractions: Maryland tourism information is available by calling 800-543-1036 or on the Internet at http://city.net/countries/united_states/maryland/.

Washington DC tourism information is available by calling 202-347-2873 or on the Internet at http://city.net/countries/united_states/district_of_columbia/.

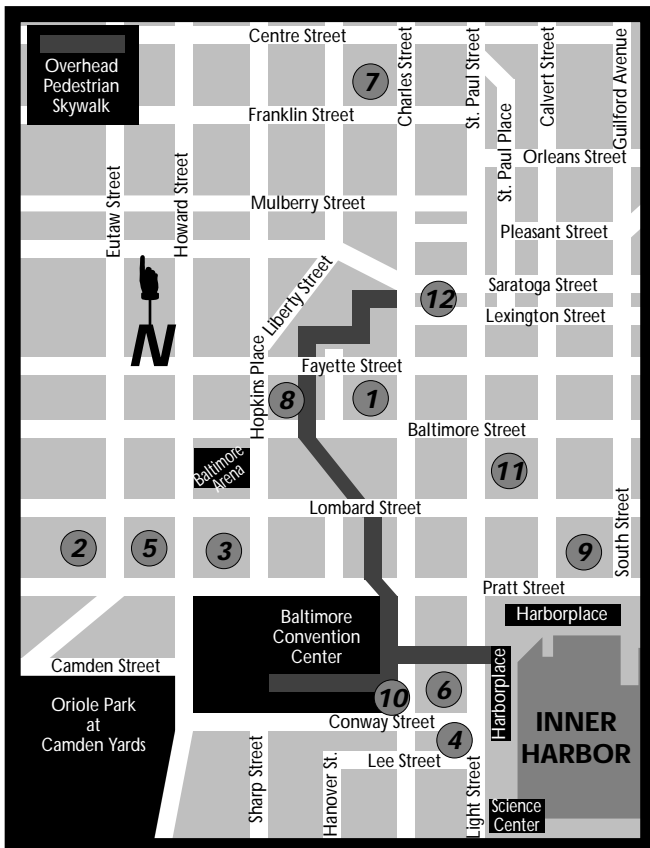
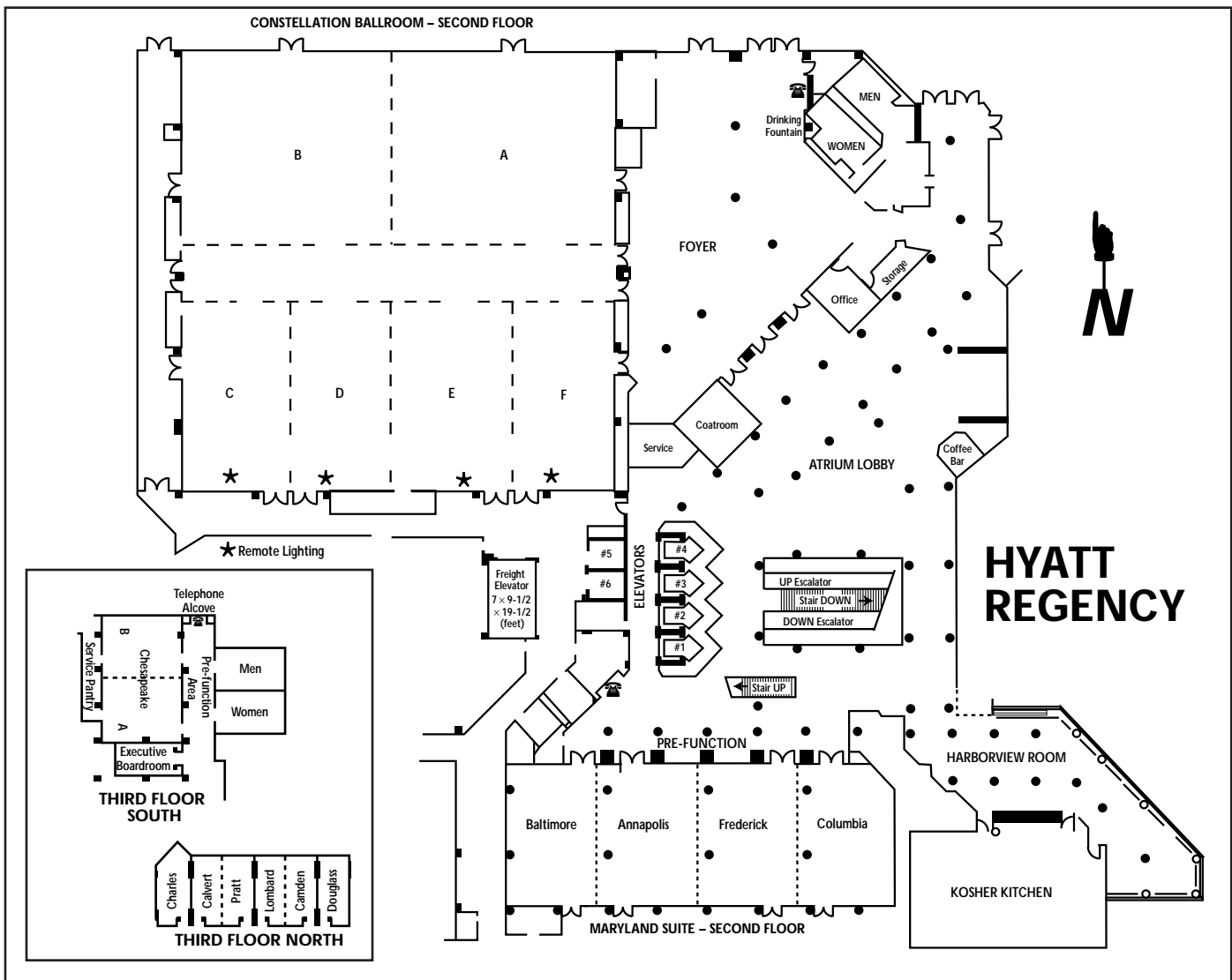
SOCIAL EVENTS

Microwave Journal/MTT-S Reception: All Microwave Week attendees and exhibitors are invited to attend a reception hosted by *Microwave Journal* and MTT-S on Monday, June 8 from 6:00 to 10:00 PM at the Maryland Science Center, which is located adjacent to Baltimore's Inner Harbor (walking distance from the Baltimore Convention Center and most IMS hotels). Come enjoy the Center's three floors of hands-on exhibits, world-famous Davis Planetarium and impressive IMAX theater, along with beverages and hors d'oeuvres.

Maryland Crab Feast at Oriole's Ballpark: "Maryland is for Crabs," and so the IMS Steering Committee will be sponsoring a Crab Feast on Tuesday evening, June 9. This event is one of the most informal and entertaining activities during the IMS. Those who attended the 1986 IMS Crab Feast in Baltimore remember that evening as the "not to be missed" social event. The crab feast will be at the Oriole Ballpark at Camden Yards adjacent to the Convention Center. Other food such as beef, ribs, etc. will also be served. Unfortunately, because of space limitations, attendance will have to be limited. The Steering Committee suggests you buy your tickets early for this event to assure your place at the table.

Industry-hosted Cocktail Reception: On Wednesday, June 10 from 6:00 to 7:30 PM at the Hyatt, just prior to the Award's Banquet, symposium exhibitors will host a cocktail reception. Complimentary beverage tickets will be included in the registration packages.

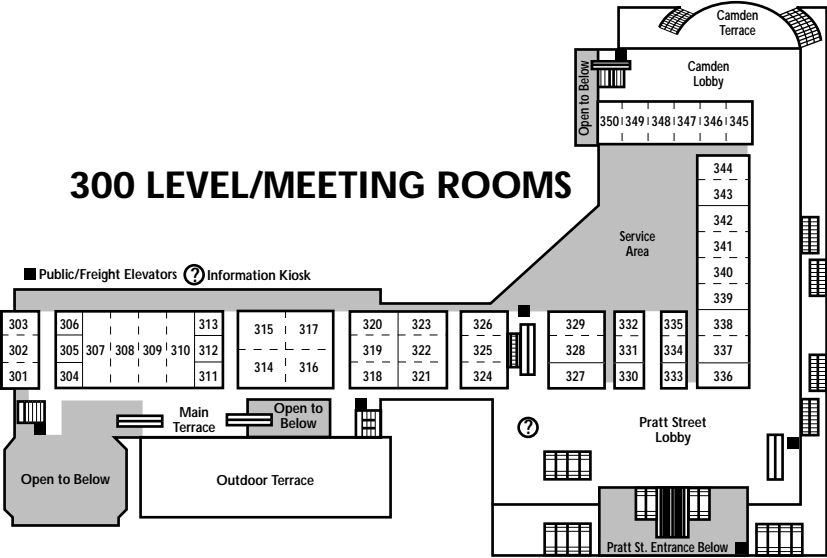
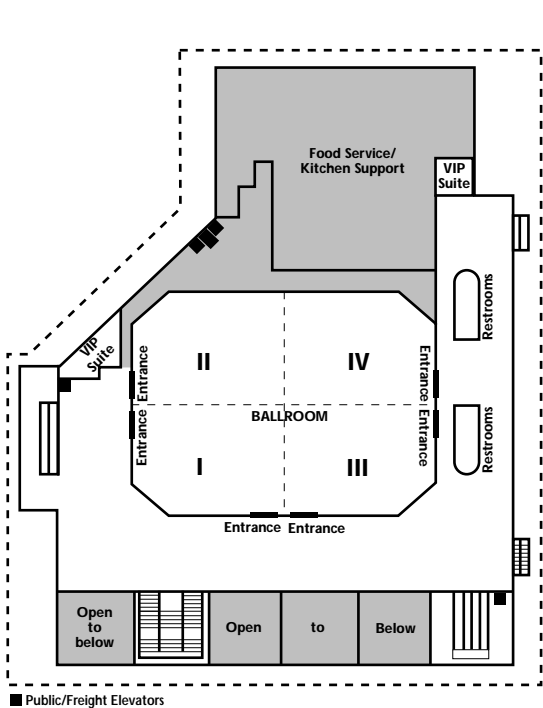
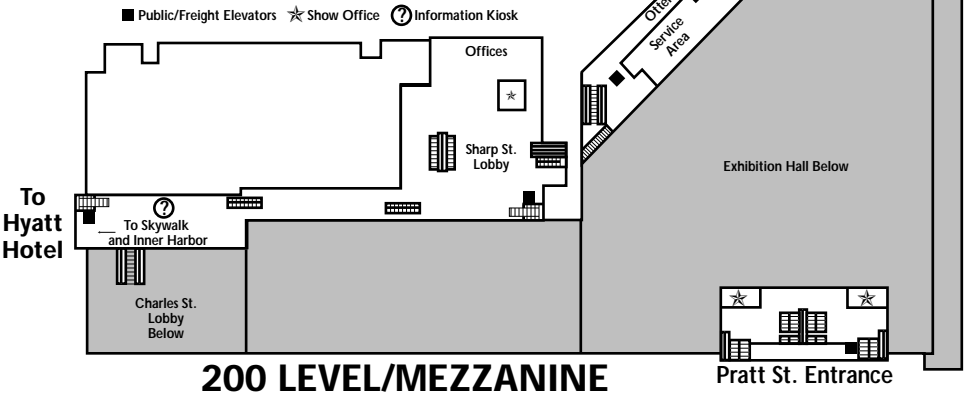
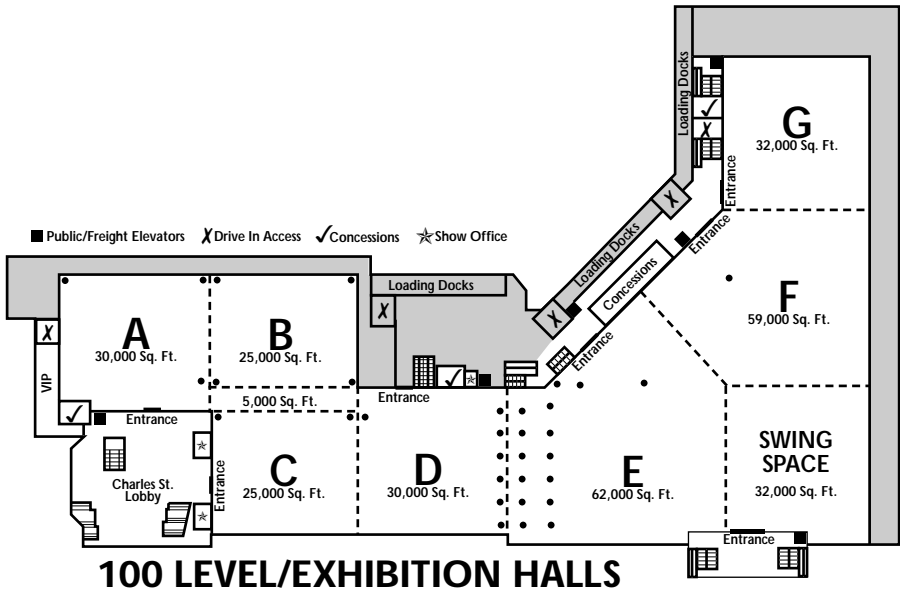
IEEE MTT-S Awards Banquet: The annual Awards Banquet will be held on Wednesday, June 10 from 7:30 to 10:00 PM in the Ballroom of the Hyatt. Presentations of major MTT-S awards, Fellow awards and Student Paper Contest awards will be made before, during and after an elegant dinner. Accompanying entertainment will involve themes from Maryland's ancestry. The Washington DC/Northern Virginia Chapter of MTT-S will be celebrating its 40th anniversary at the banquet. Please use the registration form on page 7 to make your reservation(s).



1998 IMS HOTELS

- | | |
|----|---------------------------------|
| 1 | Baltimore Hilton & Towers |
| 2 | Baltimore Marriott Inner Harbor |
| 3 | Days Inn Inner Harbor |
| 4 | Harbor Court Hotel |
| 5 | Holiday Inn |
| 6 | Hyatt Regency Baltimore |
| | (Headquarters) |
| 7 | Mount Vernon Hotel |
| 8 | Omni Inner Harbor Hotel |
| 9 | Renaissance Harbor Place |
| 10 | Sheraton Inner Harbor |
| 11 | The Brookshire Suite Hotel |
| 12 | Tremont Plaza |

BALTIMORE CONVENTION CENTER

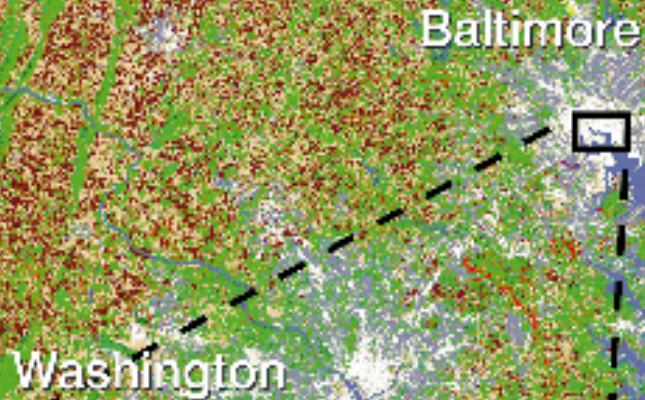


1998 International Microwave Symposium

<http://estd-www.nrl.navy.mil/ims/1998ims.html>

Baltimore

Washington



- 450+ Technical Papers
- 24 Workshops
- 6 Panel Sessions
- RFIC Conference
- ARFTG Conference
- 370+ Exhibitors
- Awards Banquet
- Historic Exhibit
- Guests Program
- Microwave Journal Reception
- Inner Harbor Attractions
- Crab Feast
- Plenary Session
- Live Satellite Link



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Westinghouse AN/APQ-56
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